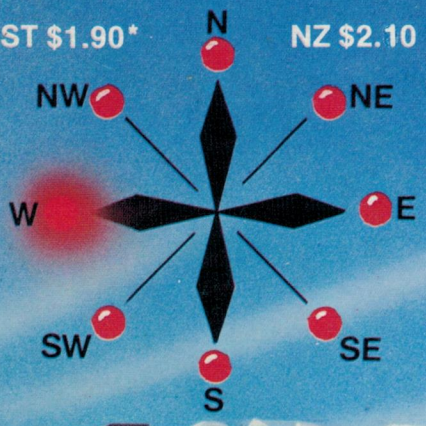
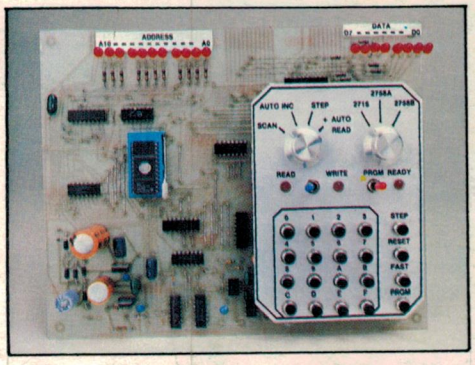
ELECTRONICS AUSTRALIA

VIDEO, HIFI & COMPUTERS

JANUARY, 1982 AUST $1.90* NZ $2.10



Simple low-cost WIND INDICATOR



Build this EPROM PROGRAMMER

● STATIONS LIST ● SHARP'S NEW VERTICAL PLAYER SYSTEM

What is your turntable's "warp factor"?

You may not realize it but every record has some degree of warp. And no matter how slight, it can give your turntable fits.

Warp, along with off-centring, were the reasons why Sony invented Biotracer.

The continuously correcting action of the electronic Biotracer tonearm perfectly suspends the stylus in the record grooves with no tension resulting from the forces of gravity or lateral pressure.

Biotracer is featured on Sony's PS-X600 and X500 with the advantages of stifling low frequency resonance, expanding dynamic range and maximizing performance from any cartridge you use. Biotracer also suppresses peak tonearm resonance electronically within a range of 3dB.

The sole object of its design was to neutralize the effects of record warp and off-centring through microcomputer precision. Which Sony does with aplomb.

PS-X600

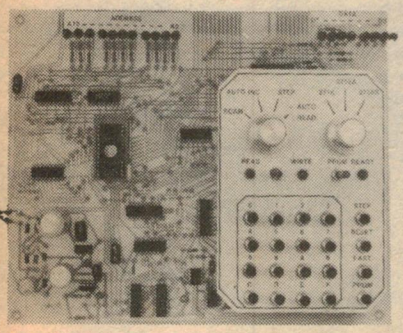
SONY®
THE ONE AND ONLY

SON 0115

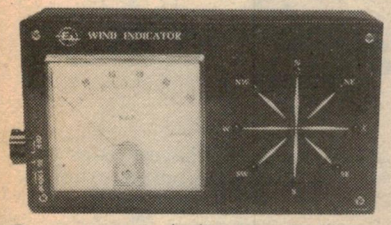
ELECTRONICS AUSTRALIA

Volume 44, No. 1
January, 1982

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE



Suitable for 2716/2758 EPROMs, this inexpensive EPROM Programmer operates without the need for a personal computer or microprocessor system. Find out how to build it on p42.



Our new wind direction indicator gives wind indication at eight points of the compass and uses only two wires between the remote sender and the electronic indicator. Details p54.

500MHz DFM: unfortunately, lack of space has prevented us from running the second article on the new 500MHz DFM in this issue. The article will be presented in February, along with those projects listed on p106.

On the cover

You will always know which way the wind is blowing with our new wind direction indicator featured on p54. Inset shows our new EPROM Programmer for 2716/2758 EPROMs (see also above). Cover artwork by Andrew Powell.

FEATURES

HIFI, VIDEO AND REVIEWS

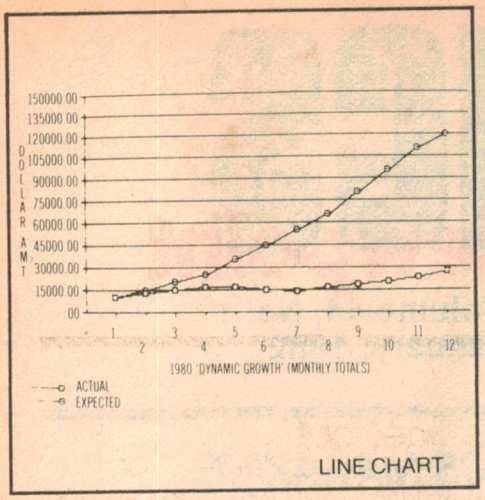
PROJECTS AND CIRCUITS

MICROCOMPUTERS

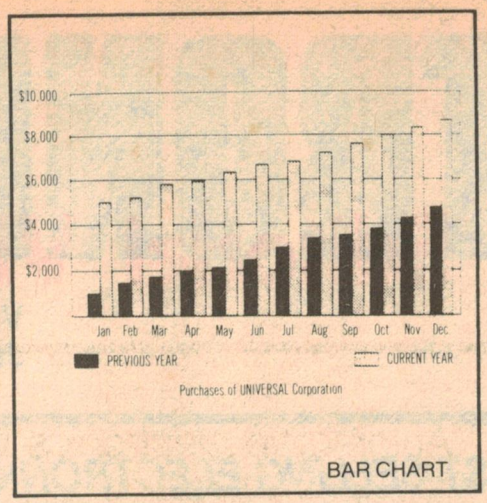
AMATEUR RADIO, CB SCENE, DX

COLUMNS

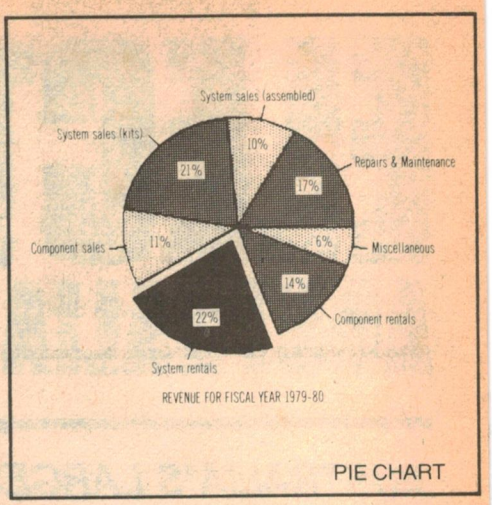
DEPARTMENTS



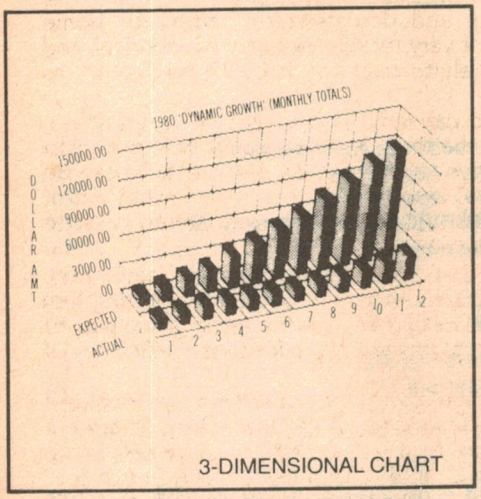
LINE CHART



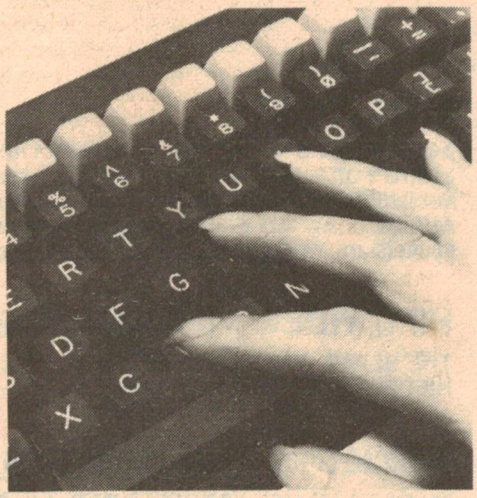
BAR CHART

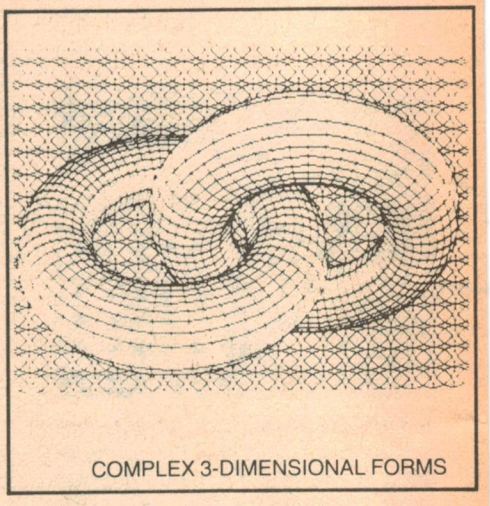


PIE CHART



3-DIMENSIONAL CHART

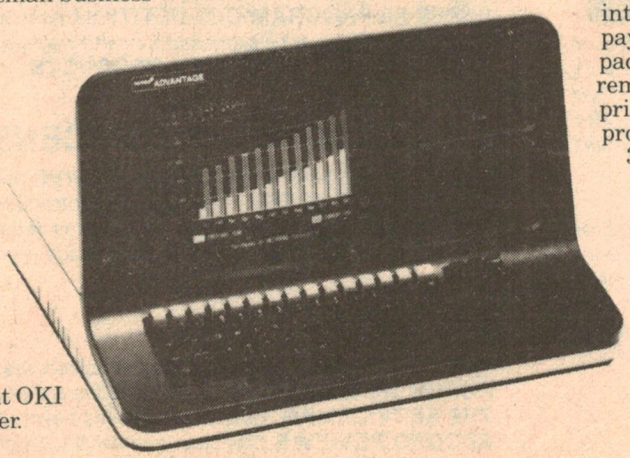




COMPLEX 3-DIMENSIONAL FORMS

A business with all this at its fingertips must have an ®Advantage.

With the North Star Advantage, A.D.E. can now offer to the computer industry a significant small business computer breakthrough. For the first time there is available a high performance, fully integrated desktop computer capable of producing bar charts, pie charts, plotted graphics and three-dimensional visuals.
The Advantage's features include two integrated double-sides, double-density floppy disk drives, an 87 key Selectric® style keyboard which includes 15 programmable function keys, a 12-inch green graphics display, business graphics software and self-diagnostic capabilities. The A.D.E Advantage package is completed with the excellent OKI Microline 82A Serial Dot Matrix Printer.



The small business computer user will be able to integrate graphics into everyday business without paying a premium. The Advantage package is available for a remarkable $5,595. At that sort of price, and with the ability to produce everything from a 3-dimensional visual to a pie chart, the Advantage will give businessmen a chance to grab a bigger slice of the profit pie. Talk to your A.D.E. Representative now.

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Editorial Viewpoint

Automotive electronics is fine, but . . .

A recent item in an overseas magazine caused me to think back to the late '40s, when we first got involved in designing and describing car radios for home construction. They were valve type sets, not very reliable, not very economical, and their vibrator type power supplies were likely to create as much RF interference as the vehicle's own ignition system!

By comparison, a modern, transistorised car radio is a model of compactness, reliability and economy in both senses of the term. It requires very little power to operate and, if saving dollars is an objective, a push-button AM car radio can be bought complete for less than $50. But that kind of economy is somewhat out of fashion nowadays, with many buyers preferring AM/FM receivers, stereo cassette players and the trappings of full hifi reproduction.

But electronics is also becoming involved in the actual operation of family cars, with electronic ignition almost "old hat", microprocessors already monitoring fuel and other engine functions, and mechanical instruments on the fascia giving way to electronic readout systems. All this is aimed at increasing the functional efficiency of the vehicle.

The item to which I referred earlier took these things for granted but was looking a bit further down the track to gadgetry dedicated to operational safety. Imagine a synthesised voice that warns you, as you go to drive off, that a safety belt is not fastened, that a door is not securely closed, or the handbrake is still in the "on" position. Or yet again, that some abnormal situation is developing which might ultimately immobilise or endanger the vehicle.

Considering all this current and up-and-coming gadgetry, one wonders how well auto maintenance mechanics will cope with it. The probable answer is that they won't. If an instrument fails, an engine "computer" malfunctions or a synthetic voice stops talking, it will be replaced rather than fixed, most likely, to become yet another casualty of the throw-away society.

I also wonder for how long replacements for such throwaways will be available. Today, 10-year-old cars are being heavily devalued because of the scarcity of purely mechanical replacement components. But, in electronic chip technology, even five years is sufficient to transform state-of-the-art into obsolesence.

One would hope that this fact is not overlooked, as we move into the era of electronic motoring. It would be a poor bargain if the rapid obsolesence and throw-away mentality of modern electronics were to immobilise tomorrow's vehicles while they were still mechanically sound.

Neville Williams

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News Highlights

General Motors runs into problems with computer controlled Cadillac

Owners of the new 1981 Cadillacs with the 8-6-4 cylinder option may have some heated words to say about computer control of the engine, according to a US report. The "intelligent Cadillac" features an electronic control system that calculates how many cylinders are needed to provide the power the driver asks for and adjusts the engine accordingly.

For cruising on the highway in top gear, four cylinders may suffice, while pulling away from a stop light probably requires all eight cylinders for best performance. The microcomputer under the car's hood is supposed to tailor engine performance to the driving situation.

Designers at General Motors didn't stop there, however. They felt that if the processor was there they might as well put it to full use. Thus the speedometer, is digital, the ignition and fuel systems are all electronic and, according to one US report, "so are the bugs".

The computer command and control system, as it is known, provides regulation not only for the engine but for other parts of the car, including the air conditioning and the clutch on vehicles fitted with automatic transmissions. General-Motors has made a major commitment to the use of microprocessors in cars, indicating its confidence in the new technology by offering a five-year warranty.

Almost immediately after the new Cadillac was introduced however, reports came in that the 8-6-4 control system was stalling the engine at critical moments. In some situations the microcontroller just couldn't cope. Sudden braking followed by hard acceleration was one such situation. The length of time the car was driven also made a difference, as apparently the computer wasn't programmed to match the warm up characteristics of the mechanical parts it monitored.

One report told of a $6000 repair bill on the $10,000 car. Fortunately for the owner the warranty covered the costs, although not the time lost while the car was in the workshop.

The same owner discovered some undocumented features of the car's control system. It seems that the control unit is programmed to "remember" certain things, such as if the car has ever been driven over 128km/h, or if the owner failed to bring it in for repair within 15 starts if the "check engine" light came on. Both void the warranty on the car.

Lower cost for Prestel terminals

Prices for entry to the UK Prestel system are likely to drop dramatically as a result of the use of new integrated circuit viewdata adapter chips. In contrast to $1600 for a full TV set with built-in teletext and viewdata decoder, new adapters will cost around $400 each.

British manufacturers of viewdata equipment are hoping that the lower prices will encourage more people to join Prestel. Official estimates last year predicted sales in the UK of 40,000 business and 6000 private Prestel installations. In contrast, the total installed base is around 13,000 units.

Heading the field in supply of adapter chips sets are Mullard and General Instrument Microelectronics Ltd, although Texas Instruments and Marconi Electronic Devices Ltd are also in the market. The Mullard board uses an Intel 8049 microprocessor and a new large scale IC called Lucy (line-coupling-unit asynchronous receiver transmitter). Previous systems used up to 16 standard ICs to achieve the same functions integrated into the Lucy chip.

Low cost Prestel adapters are currently being manufactured by Radofin Ltd, Tangerine Ltd, Oracle Ltd and Ayr Viewdata Ltd.

Micropad lets computer verify signatures

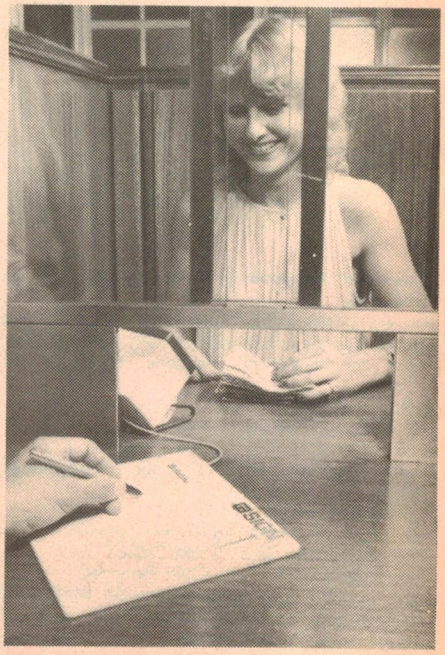
At right is the Micropad Q-Sign, the first of a new range of products from Quest Automation in the UK. Q-Sign is a computer-signature verification system which can be used with any computer allowing handwritten information to be read directly by the computer.

With more and more sensitive data being stored on computers, security is becoming an increasing concern. One major problem is how to identify those users which are entitled to access confidential files. Fingerprints have connotations which make the process unpopular with employees, while coded cards and keys can be lost. Even voice identification systems can be defeated by a high fidelity tape recorder. A signature cannot be lost, stolen, forgotten or easily forged, and is the most natural form of identification.

Q-Sign compares the user's signature with reference data stored in the computer or coded on a credit card. The technique used by Quest uses not only the shape of the signature but also the "rhythm" with which it is written. A skilled forger might be able to duplicate the signature exactly, but it would be almost impossible to do so with the same pressure and within the same time as the genuine signature.

The verification process is not based on an exact match, as no two legitimate signatures are exactly alike, but on a degree of matching within a defined limit. This limit can be varied according to the user's requirements.

For further information, contact Micropad Pty Ltd, Suite 402, 325 Chapel Street, Prahan, Vic 3181.



Going up in a talking lift

Half of the people in any lift are likely to be scared out of their wits, according to researchers at Otis Elevator Company. Research has shown that one in two people have some phobia or another which is heightened when riding in lifts, says the company.

For this and other reasons, the new Elevonic 401 lift from Otis incorporates a speech synthesiser-semiconductor chips which can "talk" reassuringly to lift passengers. Apart from safety messages such as "Please stand clear of the closing doors", the lift can wish passengers a happy day, give them a weather report, or remind that they are running late.

Blind people using the lift have the advantage of spoken floor announcements, and the new control panel has been specially designed to allow handicapped people to use it easily. Another feature turns the lift into a visual display centre, with a 16 character alphanumeric display built into the operating panel. The display can flash the time, weather, information and advertisements to divert the passenger on the way up.

Tote that cotton and lift that bale

Computers will soon come to the assistance of Australia's cotton growers as a result of the efforts of a new firm, Siratac Ltd, formed to enable the cotton industry to take advantage of research by the CSIRO.

Siratac offers a computer-based crop management program for cotton growing, jointly developed by the CSIRO and the NSW Department of Agriculture. The new company was launched late last year in Narrabri, centre of the NSW cotton industry. It is a non-profit organisation, partly financed by a 25c per bale levy voted by Australian cotton farmers.

The crop management program user uses a computer to provide for pest control and to monitor water use in cotton crops. One of is aims is to minimise the use of pesticides. The computer processes data gathered in the field on insect pests and their predators, weather conditions and crop maturity and advises the farmer on whether a spray is necessary and the type of pesticide which could be used. He is also given a summary of the crop and pest situation on his farm.

Trials carried out in the Namoi Valley over the past three seasons indicate that Siratac managed farms had similar yields and crop quality with up to 50% fewer sprays than unmanaged blocks.

F-18 radars to be made in Australia

Philips Industries Holdings has been selected by the United States Hughes Aircraft Corporation to undertake the radar system offset work for Australia's new tactical fighter, the McDonnel-Douglas F-18 Hornet.

Australia recently agreed to purchase 75 Hornets, and Hughes Aircraft will supply the radar systems for the US versions of the plane. As part of the contractual arrangements for the Australian version, Philips will manufacture the sophisticated radar systems under licence in Australia.

Philips has been sub-contracted by Hughes to undertake final assembly and test of the APG-65 radars, to manufacture, assemble and test radar data processors, and to participate in the radar test system of the F-18.

The contract will be worth about $40 million to Philips over the 10-year life of the project, and the work will require the appointment of an additional 50 to 60 technical staff at the company's Moorebank facility. The first radar unit is expected to be completed by early 1984.

FCC moves on computer EMI emissions

With microprocessors rapidly becoming the mainstay of consumer and industrial electronic devices, the United States government has become increasingly concerned with radio frequency interference generated by high speed digital circuits.

Following the announcement in 1979 that the Federal Communications Commission would begin to regulate the microcomputer industry, manufacturers have spent many thousands of dollars to meet the FCC's radiation standards, at the same time applying for waivers to allow them to continue to sell equipment which does not meet the standards. Recently the FCC clamped down – no more waivers will be granted.

Under the FCC regulations, Class B computing equipment designed for use in the home could not be sold after January 1, 1981 unless certified by FCC testing laboratories or under waiver. Measurements are made on both radiated and mains-borne interference.

Requirements for Class A equipment – commercial and industrial – are less stringent. According to the FCC, there is more potential for interference with radio and television in the home, and home computers are not likely to be maintained with the same care as Class A equipment.

Costs of meeting the interference standards are high, and not only small companies need the waiver requirements. Apple, Tandy and Heathkit have all applied for waivers while they redesign their products.

The redesign of the Apple II "took more than several months," says Michael Connor, Apple's product marketing manager. "It took lots of equipment and lots of manpower. And trying to find people that understand radio-frequency interference and digital electronics is not an easy task".

Soanar in South Australia

Soanar Electronics Pty Ltd has announced the appointment of David Symonds as Sales Manager for South Australia. Mr Symonds has been Soanar's specialist semiconductor representative in South Australia for the past three years.

Soanar recently moved into larger premises at 30 Beaulah Road, Norwood, SA.

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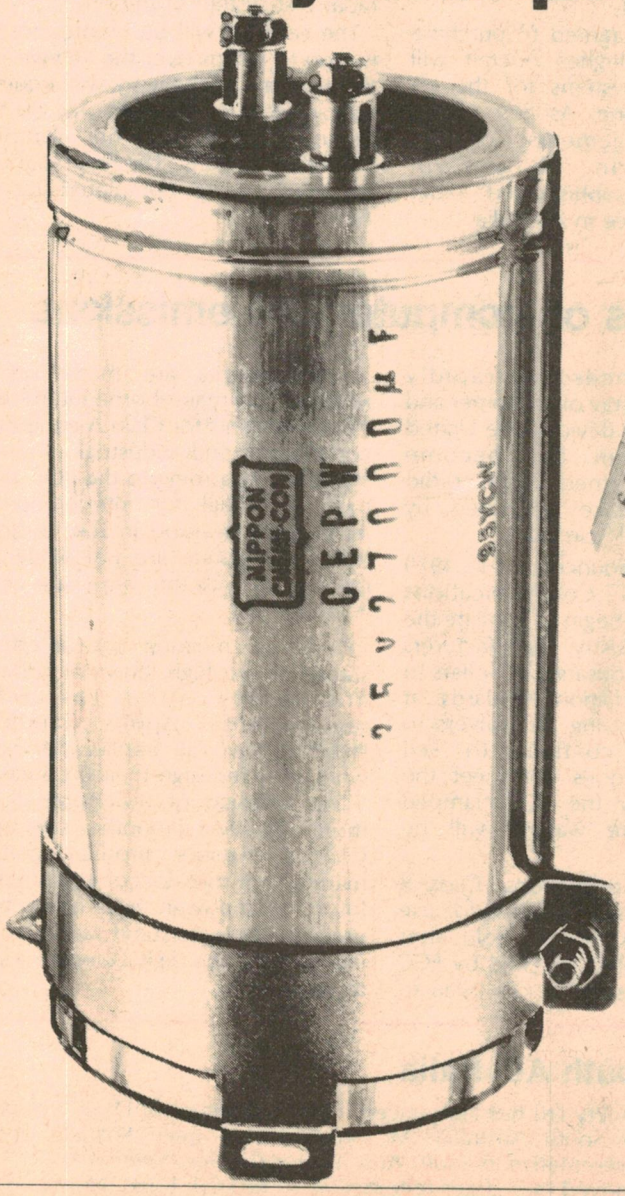

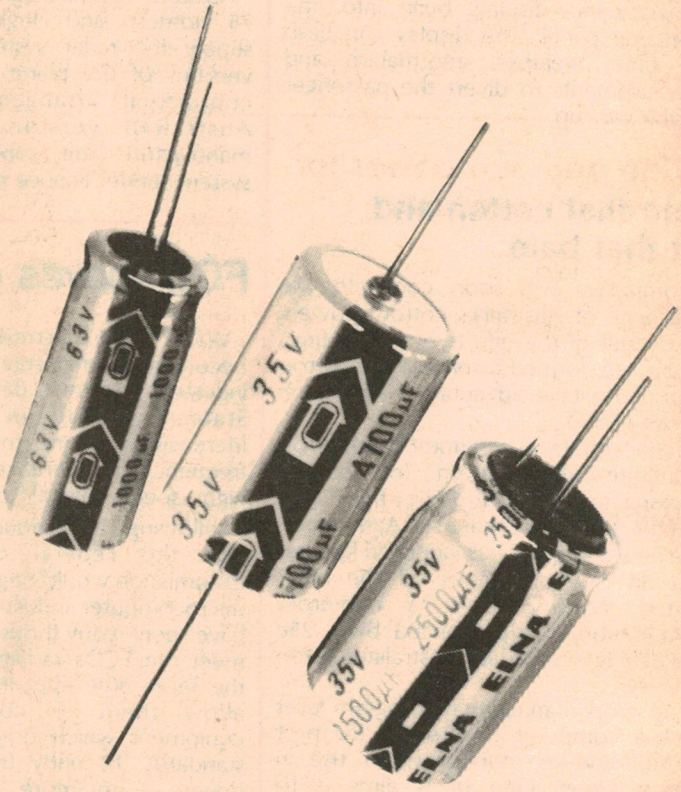

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NEWS HIGHLIGHTS

Japanese robots on the move

Growing demand for industrial robots has led to the signing of an agreement between Japan's Kawasaki Heavy Industries and the US Unimation group. The agreement will allow Kawasaki to market its range of industrial robots in Europe, the United States and Australia through Unimation's vast marketing network.

There are around 20,000 robots in use around the world and the international market is expected to be worth $US600 million by the end of the decade. Half the current robot population is in Japan, which remains the leader in the manufacture and development of industrial robots.

One Japanese company, Yamazaki Iron Works, is currently offering overseas clients an unmanned, fully automated factory which can do the work of a plant employing 250 people. Costing around $A15 million, the factory works around the clock, requiring only two shifts of six human workers to check its operation during the day.

The entire plant is controlled by six computers which cover every facet of the two main production lines. Currently operating in Japan, one of the factories produces lathes and machine tools, relying on advanced robots and computer-controlled machine tools.

In Australia there are 181 robotic installations in use at the moment. They include 122 highly sophisticated "playback" robots and 59 limited sequence machines.

At the moment their main application in Australia is in the metals and motor industries, where they are used mostly for spot welding and spray painting. Nissan and Ford are currently using robots in these areas, most of them imported from either the US or Japan, although there are an increasing number of European companies interested in selling machines in this country.

Wind and sun power for television repeater

The first television transmitter using wind and solar power has been set up by the UK Independent Broadcasting Authority at Bossiney in Cornwall. An experimental station, the relay transmitter will provide ITV and BBC programs to about 300 people.

Power for the transmitter is provided by wind or solar generators or by a bank of 36 lead acid batteries which will be kept charged by excess power from the generators. The wind generator has an output of 150W at a windspeed of seven metres a second. Twenty-four solar panels, each consisting of 864 silicon cells provide 780W in peak sunlight. The transmitting equipment has a power consumption of about 150W.

Electronic office network by British Telecom

Electronic office services – electronic mail, forms processing, data management, correspondence and appointments diaries – will be offered by British Telecom this year. At the heart of the system will be an "electronic mailbox" for business users, providing facilities such as express delivery, internal correspondence and filing services.

The new services will be aimed at medium to large companies, for internal use, enabling them to achieve significant improvements in productivity and management efficiency by eliminating a great deal of time-consuming internal paperwork.

The bureau services will be run on Prime 750 computers and customers will use their own terminals – printers, visual display units or Prestel sets equipped with an alphanumeric keyboard. They will link to the central computer by dialling up over the telephone network, or by using PSS, British Telecom's packet switched data service.

Meanwhile, a report by US market research firm International Resource Development Inc claims that new home information services have already made the electronic newspaper a reality. The report predicts that electronic news services will grow to a $500 million business this decade, evenly divided between home and business services.

According to the report, the real potential of electronic news lies in providing information in greater depth than ordinary newspapers. Several different media are expected to emerge, including "Demand updates" in which a user with a videotext terminal or computer interrogates a news database to obtain more detailed information than given in the paper version of the news.

"Fly by wire" Jaguar makes first test flight

Unstable aircraft – which would crash if left to themselves, even for a second – are the latest product of the search for high speed agility in fighter aircraft. A pilot using conventional controls would find it quite impossible to fly the aircraft, which is where the ubiquitous computer comes in.

The world's first aircraft to fly solely with an all digital "fly-by-wire" control system was test flown in October last year. The aircraft is an extensively modified Jaguar GR MK1. In effect, the fly-by-wire system replaces all the mechanical units, autostabilisers and cumbersome control rods currently used to move the control surfaces.

Instead, there are four independent communications channels, relaying instructions from four high speed, self-monitoring computers. These are linked with a further two subsidiary actuator drive computers, leading to a triple-safe "failure absorption" actuator. Control signals are issued in response to the pilot's demands, and also in response to uncommanded aircraft motions detected by sensors.

Control of the plane requires that flight corrections be made many times a second, a demand impossible for a human pilot to fulfil unaided. With computer control, fighter aeroplanes of the future will be smaller, lighter and more manoeuvrable.

Electronics courses at Newcastle Technical College

Newcastle Technical College will offer a range of trade, post-trade and special courses in electronics in 1982.

A part time electronics trades course is offered, covering all aspects of analog and digital design. Required attendance is one day and two night lectures per week and a block release for practical training. This is a three year course.

Post Trade courses are available in television receiver principles, industrial electronics and semiconductor electronics. Special courses available include microprocessor evaluation, microprocessor circuits and applications, film and television production for education and industry, principles of two-way radio and a two-way radio users course.

Enquiries should be made to The Senior Head Teacher, School of Electronics, Newcastle Technical College, Maitland Rd, Tighes Hill 2297. The college will be open for enrolments, from Monday February 1.

Best bass yet from a kit!

As featured in Electronics Australia Projects June and July 1981.

Now Peerless introduces another major advance to kit-set loudspeaker technology: A bass speaker with a rigid polypropylene cone that clearly outperforms traditional paper composite cone speakers, providing:

• cleaner, tighter bass sound reproduction • low colouration and distortion • high efficiency, suiting 25W to 100W amplifiers • consistent rigid panel, low mass speaker cones.

Other outstanding features of Danish built Peerless speaker kit-sets are:

• sealed back mid-range with excellent linearity and low distortion • latest Peerless 1" soft dome tweeter • state-of-the-art crossover networks • exceptionally flat response extending to 25,000 Hz.

Peerless

Choose from these EA/Peerless speaker projects:

PAS 100	12" 3 way	100W (100L)	$364.00 pr
PAS 60	10" 3 way	90W (60L)	$214.00 pr
PAS 25	8¼" 2 way	60W (25L)	$166.00 pr

Includes drivers, crossover, wiring and instructions.

Enjoy finer sound and avoid import duties by asking your nearest dealer for Peerless polypropylene loudspeaker kits or contact:

G.R.D. GROUP Pty. Ltd.
698 Burke Road,
Camberwell, Victoria 3124 Phone: 82 1256

Please send me full details of Peerless Kit-set speakers and the name of my nearest dealer.

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Made in Australia to Australian standards for 240V, 50Hz mains with secondaries from 1.5V to 115V.

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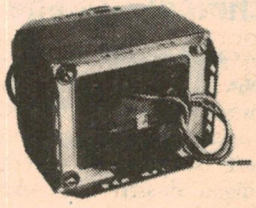
Rated from 2.5 to 350VA



LOW PROFILE

20, 40 & 60VA ratings with dual secondaries for various output voltage and current combinations. Also multi-tap 20VA version. Compact design.

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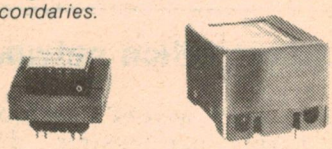
Pins located at standard 0.1" PCB grid. Ratings from 2.5 to 15VA with dual secondaries.



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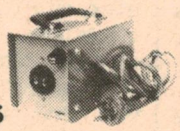

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Cable link across the Pacific to complement satellite communications

An international co-operative effort between many nations has ensured that when the present COMPAC communications cable reaches the end of its useful life there will be a replacement in the form of the ANZCAN undersea cable. Australia, New Zealand and Canada are particularly involved in the project.

Work on the ANZCAN project, in which the Overseas Telecommunications Commission (Australia) is the major partner, will have been under way for several months by the time this article appears. While it has had some publicity, the sheer size of the project and its technological complexity are not fully appreciated.

In purely monetary terms it will cost about $400 million (Australia's share will be about half that) and it is acknowledged as the largest international telecommunications project the world has seen. The cable will be 15,000km long and will cross the Pacific at depths of up to 5.6km. It will provide Australia with additional links to Norfolk Island, New Zealand, Fiji, Hawaii and Canada, give direct access to communications networks in North America, and provide similar access to Europe via other cable and microwave links.

Once completed in 1984, it will carry most types of telecommunications traffic including telephone, telex, facsimile and data. It will be capable of handling over 1300 simultaneous telephone calls, 16 times as many as the old COMPAC cable, laid in 1962.

Obviously there has been close international co-operation between Australia, New Zealand and Canada in the planning of the ANZCAN cable, but many other nations are involved. Other part owners of the project are Fiji, Britain, France, the Federal Republic of Germany, Papua New Guinea, Ireland, the Philippines, Italy, Switzerland and Japan. The United States and several other nations will also make use of the ANZCAN cable as an international telecommunications link.

Standard Telephones and Cables Limited, of the UK, and the Nippon Electric Co Ltd, of Japan, both with major Australian involvement creating scores of jobs in this country, will manufacture and lay the cable system. STC won the $300 million contract to supply and install the Sydney-Vancouver cable while the $30 million contract for the 1370km spur cable between Norfolk Island and Auckland went to Nippon Electric.

In view of the number of communications satellites already in space and the launching of Australia's own National Communications Satellite System, proposed for 1985, it is fair to ask why we need an undersea cable for communications traffic. The simple answer is that countries are reluctant to rely too heavily on only one mode of communication. Cables and satellites are complementary in the international communications network and provide backup services for each other in emergencies. The submarine cable is far from being an outdated concept, even in these days of space technology, and will be required to handle, with satellites, the world's communications traffic for many years.

I am indebted to OTC for the technical data which follows:

The new cable system is the equivalent of a four-wire transmission system and will transmit frequency division multiplex (FDM) signals in both directions over a single coaxial cable. It total frequency bandwidths of 14MHz (Australia-Canada) and 5MHz (Norfolk Island-New Zealand) will be divided into equal high and low bands carrying signals in opposite directions.

Filters on submerged repeater amplifiers placed at uniform intervals along the cable will separate the high and low band paths before amplification and recombine them afterwards.

Deep-water repeaters will be equipped with crystal supervisory oscillators providing a tone unique to each repeater on an alternate basis in the high and low bands. These tones will allow cable breaks to be easily located.

The two most important and cost-sensitive design parameters are the signal load per voice channel and the noise generated per kilometre. The design load of −12.5dBm0 per 3kHz voice channel will be twice the average load due to normal speech to allow time sharing of speech channels using special speech concentration equipment. Up to 3680 speech circuits can be derived from the cable based on 1840 (3kHz spaced) voice channel capacity. In practice, the cable will carry a mixture of 3kHz and 4kHz spaced channels to satisfy the needs of the different administrations.

The terminal equipment at the ends of each of the five cable segments will consist of power feed, wideband and lower order transmission equipment. The power feed and wideband transmission equipment will be duplicated to increase reliability and ease maintenance.

The power feed equipment will supply a constant DC current supply through the centre conductor of the coaxial cable to all the submerged repeater amplifiers in series. The cable will be powered with opposite polarity from each end at a voltage of between 1kV and 5kV depending upon the length of the segment and the number of repeaters to be powered.

The line current will be 470mA for all but the shortest cable segment (Norfolk Island/New Zealand) where it will be 100mA. Under power feed fault conditions, the shorter cable segments can be fed from one cable terminal only.

The wideband terminal equipment will convert the FDM baseband to and from line frequencies. It will be connected to the submarine cable by means of directional filters to inject and extract high and low band transmit-and-receive signals separately.

The wideband terminal equipment will be interconnected with lower order transmission equipment converting the baseband to and from groups of circuits arranged in a standard international FDM plan in varying hierarchies down as far as the voice band channels required to meet the through and terminating traffic requirements at each of the five cable stations.

Manufacturing of the submerged equipment is highly specialised to achieve the high degree of reliability demanded over the cable's design life of 25 years. Repeaters will be manufactured and assembled under clinically clean conditions to ensure long trouble-free operation. The completed repeaters will be hermetically sealed in brass cylinders in an atmosphere of dry nitrogen and encased in steel sea housings.

The 37.34mm lightweight coaxial cable will have a high tensile steel core surrounded by a copper tube continuously welded along its length to form the inner conductor. A low density polyethylene dielectric will then be applied and shaved to the precise diameter required. Over this core will be an aluminium outer conductor and a layer of protective polyethylene. For shallow water, the cable will be armoured with galvanised steel wires sandwiched between layers of polypropylene rope.

Two vessels will lay the main and spur cables between late 1982 and early 1984. These ships will be fitted with sophisticated navigation systems, including satellite communications, to ensure the cable is laid exactly on the route selected from ocean survey results.

R. B. Lansdown, Secretary,
Department of Communications

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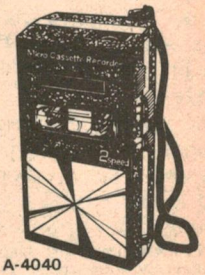

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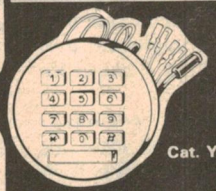

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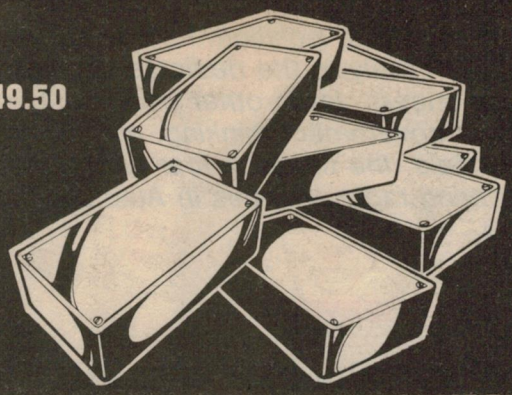

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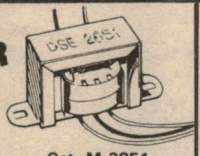

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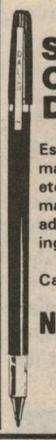

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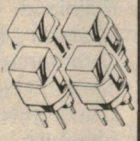

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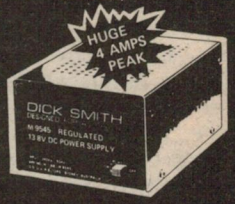

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Austr radio

For Australia, the invention of radio was to mark the end to an era of isolation. Its introduction to Australia was due mainly to the dedicated efforts of Australia's radio pioneers, for in other quarters it was hampered by slow government thinking, and commercial rivalry. This article, the first of a four part series, describes pioneering radio activities in Australia up to World War I.

by PHILIP GEEVES

Fellow of the Royal Australian Historical Society.

It is generally agreed that Australia's earliest wireless experiments took place in the physics laboratory of the University of Sydney during 1888, when Professor Richard Threlfall repeated and demonstrated the work of Heinrich Hertz. Within the next decade, as news of Marconi's pioneering achievements filtered through to Australia, a few enthusiasts began their own experiments using basic apparatus, such as induction coils, spark gaps, Leyden jars and coherers. As might be expected, some of those eager experimenters were Post Office telegraphists, whose technical training equipped them to investigate the novelty of telegraphy without wires.

In Sydney, P. B. Walker, Engineer in Chief of Telegraphs, supervised experiments with a crude spark transmitter in 1899. The equipment was set up in the GPO . . . "at the extreme ends of the building two wires were fixed, one attached to the transmitting machinery and the other to the receiveng apparatus. By touching the handle, the transmitter radiated, through space, electrical waves of very high pressure".

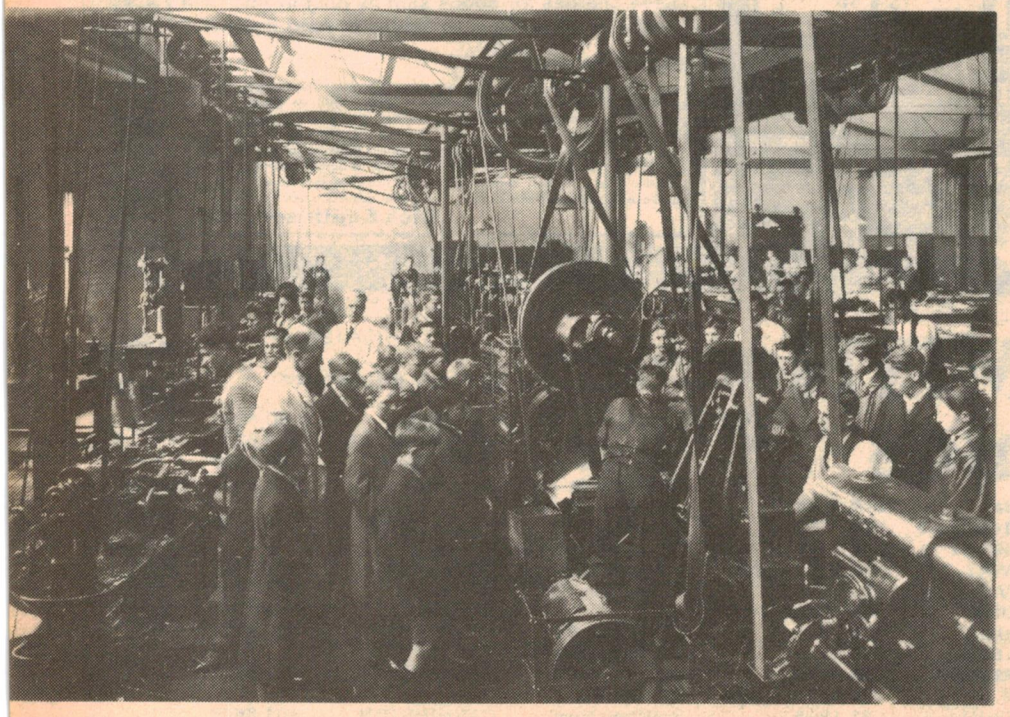
A Victorian telegraph official, H. W. Jenvey, became the leading wireless experimenter of Melbourne and inspired a number of other enthusiasts to emulate him. Walter Jenvey's leadership in the art was demonstrated during the Federation celebrations of 1901, when the Duke and Duchess of York visited Melbourne to open the first Commonwealth Parliament. Jenvey communicated successfully with one of the wireless-equipped escort cruisers and maintained contact over a distance of 17 miles in Port Phillip. This pioneer's son, W. W. Jenvey, became Chief Engineer of OTC.

But not all our early experimenters were telegraph officers. At Henley Beach, Adelaide, in 1899, Professor Bragg's aerial was said to be "the first wireless pole erected in Australia". Sydney's most advanced experimenter was a legal luminary with a passion for science and degrees in both disciplines – Frank H. Leverrier, who began experimenting in 1900, designed and made all his own apparatus, some of which is now in the Museum of Applied Arts and Sciences, Sydney.

Leverrier's first detectors comprised oxidised steel points balanced on polished steel sheet. His unique knowledge of wireless and law gained him important briefs in patent litigation. Leverrier's son, also Frank, has held an amateur licence since 1924 and remains a staunch devotee of radio.

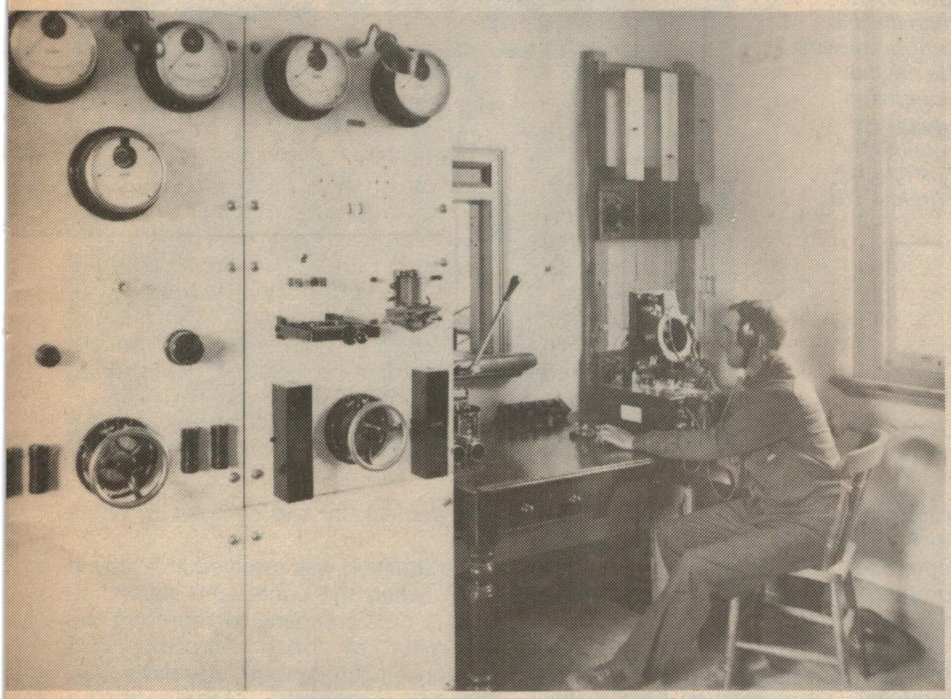
Viewed from Down Under, the success of Marconi's experiments in bridging progressively greater distances with the magic spark seemed to offer a method for linking remote settlements. When Australia's first Prime Minister, Edmund Barton, was asked about a wireless service between Tasmania and the mainland, he replied that the Marconi system had not been applied commercially to such long distances. Nevertheless, the Tasmanian Government continued to explore the possibility of wireless links with King Island and the mainland.

In October 1902 the Marconi Company submitted a proposal to the Commonwealth Government to connect Australia with New Zealand by wireless, but nothing came of the plan. The growing coolness of the British Post Office towards its imagined rival, the Marconi Company, was reflected in official Australian attitudes. Nor was the Government willing to adopt any other system, even though submissions were received from various international wireless firms, including Telefunken, Lodge-Muirhead, De Forest and Shoemaker. Australia's indecision was certainly not helped by the Admiralty recommending the adoption of Marconi's system, the same system which the British Post Office consistently opposed!



The machine shop of AWA's original factory, Sydney. Note the overhead belt drives, and the party of touring schoolboys.

alia's pioneers — 1



An operator tunes the Telefunken receiver at Pennant Hills station, Sydney, 1912.

The Marconi Company was then in a period of vigorous expansion and during 1903 another effort was made to set up a Tasmanian service: for £5000 the company offered to bridge Bass Strait with a wireless link guaranteed to handle the same volume of traffic as a submarine cable. Again the Government took no action. The time was fast approaching for Australia to announce an official wireless policy and the need became even more pressing in 1904, when the Commander of the Australian Naval Station urged the establishment of coastal wireless at strategic points around Australia's long shoreline.

When the British Government legislated to control wireless, the Commonwealth Parliament hastened to do the same. The Wireless Telegraphy Act of 1905 was the result. It gave the Postmaster-General the exclusive right to transmit and receive wireless messages in Australia, and between Australia and other countries or ships at sea, but it also provided for the PMG to grant wireless licences on prescribed terms. Harsh penalties were included for unauthorised use of wireless apparatus.

The Marconi Company was still hopeful that a practical demonstration might stir the Australian Government into adopting wireless so, following personal representations by one of its roving ambassadors, Captain L. E. Walker, the company erected spark stations at Queenscliff, Victoria, and Devonport, Tasmania. In the presence of many VIPs, messages were successfully exchanged between these stations over a distance of almost 200 miles on 12th July, 1906. The Government declined to purchase the stations, but it did agree to include in the parliamentary estimates a sum of £10,000 earmarked for wireless telegraphy.

Although "wireless" remained a profound mystery to most people, each year brought new recruits to the tiny band of enthusiastic experimenters. In 1903, for example, Father Joseph Slattery, science master at St Stanislaus' College, Bathurst, acquired a set of Marconi apparatus and, after a series of familiarisation tests, succeeded in sending messages a distance of several miles — much to the delight of his pupils and the admiration of local citizens. Another early experimenter was Charles Percy Bartholomew of Mosman, Sydney, who built his own station in 1906. Bartholomew later became a director of AWA.

The prolonged inactivity and procrastination which characterised Austalia's early flirtations with wireless ended after the important inter-Imperial Conference held in Melbourne, December 1909, at which the future provision of wireless communications in Australasia and the Pacific Islands was discussed. Australia undertook to build two land stations, one in Sydney and the other near Fremantle, to command the seaward approaches on either side of the continent.

Five tenders were received, the lowest figure of £4150 per station coming from a syndicate of Sydney businessmen trading as Australasian Wireless Limited, a firm which had hurriedly acquired the regional rights to the Telefunken "singing spark" system. The equipment for these 25kW quenched spark stations was shipped from Germany and erected here under the supervision of Telefunken engineers. The modest tender submitted by Australasian Wireless Limited contrasted sharply with the price of £19,020 per station quoted by the Marconi Company, and was eloquent testimony that Australia had become the latest battleground in the incessant commercial "war" between the two principal wireless systems of the day.

The Sydney station was eventually sited at Pennant Hills, while its Western Australian counterpart was built at Applecross. These changes of location cost the Government an additional £4000. The completion of both stations was plagued by vexatious delays, straining relations between Government and contractors. At the outset, the Pennant Hills station was designated POS (later VIS) and Applecross was originally POP (later VIP). The power for each station was supplied by 60HP Gardiner engines driving 500 cycle alternators.

1910 was a landmark year, producing a series of seemingly unconnected events which, as we now know, were to exercise a profound influence on the

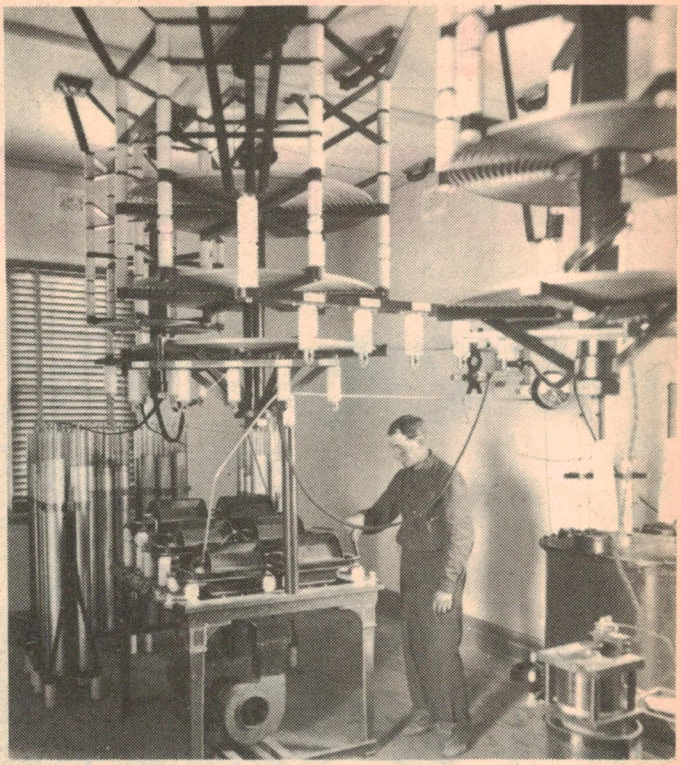
future development of Australian radio. Father Archibald Shaw, a former PMG telegraphist who had entered the Catholic priesthood, was granted an experimental licence for a station at Randwick, NSW; Australasian Wireless Ltd, successful tenderer for the first two coastal stations, opened experimental station AAA in Sydney which was destined to become Australia's first land station handling commercial traffic; George Augustine Taylor, a man of diverse interests and enthusiasms, formed the Wireless Institute of New South Wales, which had the distinction of being the first organised amateur wireless society in the British Empire and ultimately became a national organisation; Charles Dansie Maclurcan, later to emerge as the doyen of Australian experimenters, built his first telegraphy station on the roof of Sydney's Wentworth Hotel, which his family owned.

1910 was also the year that Ernest Thomas Fisk made his initial visit to Australia as Marconi operator aboard the "Otranto". Finding the rival Telefunken interests firmly entrenched, he returned here the following year as Marconi's resident engineer and for the next three decades remained the dominant figure in Australia's burgeoning electronics industry.

Perceptive observers noticed clouds on the wireless horizon. In England the Marconi Company had resorted to law to protect its patents and obtained an important judgment against the British Radio Telegraph and Telephone Company. Australia's two Government stations were Telefunken installations and despite spirited assertions that the German system did not infringe Marconi's patents, it seemed that the Commonwealth might soon be engaged in litigation.

Politicians found themselves increasingly baffled by technicalities. When Marconi marine operators, in furtherance of the wireless "war" against Germany, refused to handle traffic from Telefunken-equipped ships, politicians assumed that the two systems were incompatible. After Labor Prime Minister Andrew Fisher took office in 1910, he decided to appoint a "wireless expert" to the Postmaster-General's Department.

The man selected for this key role was John Graeme Balsillie, a young Australian who had won recognition for his technical contributions to wireless and had installed stations in Russia, China, and elsewhere. Indeed, the main criticism of Balsillie's appointment was his previous association with the firm which had been found guilty of infringing Marconi's famous "Four Sevens" – Patent No 7777. Balsillie arrived in Australia in September 1911 and promptly began sizing up the fragmented wireless scene in his native land.



The high tension room at the Pennant Hills station, showing the original Telefunken equipment installed by Australasian Wireless Ltd.

During 1911, 24-year-old Ernest Fisk commenced building up the Marconi Company's representation from a small office in Sydney. The sole business of the Australian branch was marine wireless so, after persuading a shipowner to fit Marconi equipment, Fisk would attend to the installation, hire a Post Office telegraphist with a thirst for travel and train the recruit in wireless procedures.

It was in 1911 that an experimental licence was issued to a Sydney schoolboy, Raymond Cottam Allsop, who had absorbed his knowledge from a kindly neighbour in Randwick, "the wireless missionary", Father Shaw. After war service as a marine operator, Allsop came to prominence during the 1920s and remained an honoured figure in Australian electronics until his death in 1972.

Predictably, Balsillie's appointment as the Federal "wireless expert" was viewed with apprehension by the big international firms. Their concern turned to alarm when it became known that, apart from the Telefunken stations at Pennant Hills and Applecross, all future coastal stations would use Balsillie's own circuitry and, moreover, their equipment would be supplied by Father Shaw's Randwick workshop. This bombshell touched off a spate of writs for patent infringement, far too complex to relate here.

The situation was resolved amicably in 1912, when the contestants agreed to form a new company to represent the interests of both Marconi and Telefunken throughout Australasia. The merger company, Amalgamated Wireless (Australasia) Ltd, was inaugurated in Sydney in July 1913 with Fisk as technical manager. Staffed by seasoned wireless men and with access to the patents of the world's leading systems, the firm had a formidable reservoir of technical expertise.

The formation of the company was indeed timely. The heroic role played by wireless in saving life during the "Titanic" disaster of April 1912, focused world attention on the new science. Shipowners hastened to equip their vessels with spark transmitters and adventurous Australian youths flocked to become marine operators. The Marconi School of Wireless, with George Apperley as chief instructor, was organised to train them.

And although no one realised it in 1913, there was an even more compelling reason for Australia to be self-sufficient in wireless. During the coming year a Serbian zealot would murder an Austrian archduke, lighting a powder trail that exploded around the globe. The demands of war would extend the horizons of wireless enormously and affect Australia's future in countless ways.

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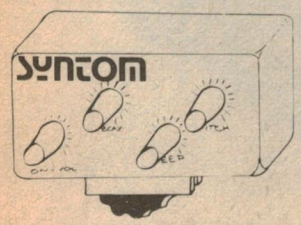

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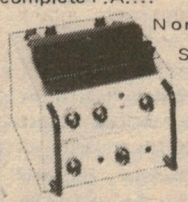

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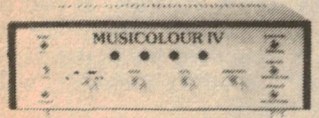

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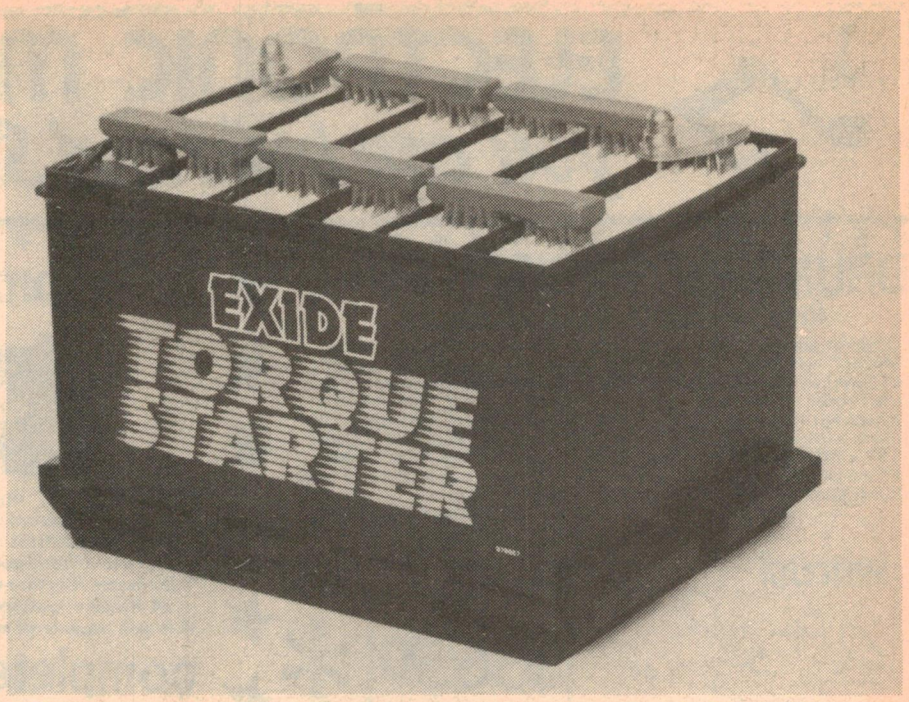
Recent press announcements by Chloride Batteries Australia Ltd, makers of Exide batteries, have claimed that their latest battery, the "Torque Starter", represents a major breakthrough in battery design. They claim that it cannot leak, cannot spill, and never needs the addition of water. In short, a true maintenance-free battery!



by PHILIP WATSON

EXIDE TORQUE STARTER

A true maintenan

Considering the claims for maintenance-free batteries which have gone before, the average reader might be pardoned for a "Ho-hum, just another maintenance-free battery" approach. That is, unless he read the fine print in the announcement. If he did he may have realised, that this really did seem to be something new.

The basis of the explanation in this announcement was that the new battery produced no hydrogen by electrolosis during charge and that any oxygen produced was recombined within the cell. As a result, there was no water loss and no gas needing to be vented to the atmosphere. Hence the battery could be totally sealed and would never need the addition of water.

This sounded all very fine as far as it went, but how was it achieved? How could the negative plate, which normally generates hydrogen, be prevented from so doing? And, just as intriguing, how could the oxygen be recombined with the electrolyte?

Well, with the ready co-operation of Chloride Australia executives – particularly Mr J. Moseley, Marketing Manager, Automotive; Mr T. J. Taylor, Technical Director; and Mr F. W. Bennett, Electrical Design and Chief Chemist – we eventually pieced together the full story; and a most interesting one it proved to be.

Conventional Batteries

But first, it may help the reader if we briefly recap the behaviour of a conventional automotive lead-acid battery and the more recently developed "low-maintenance" or "minimum-maintenance" version (also sometimes called "maintenance-free", but the term is something of a misnomer).

In a conventional battery the early part of the charging cycle produces little or no hydrogen and oxygen; almost all the electrical energy is usefully employed producing the chemical changes necessary to charge the battery. It is only when the battery approaches full charge that significant quantities of gas are produced and, in the past, the "gassing freely" condition was often used as a rough indication of a full charge condition.

But the evolution of these gasses is clearly undesirable. They represent a waste of charging energy, they combine to create a highly explosive mixture – as many victims will testify – they represent a loss of electrolyte, and they can loosen particles of active material from the plates.

Until recently, these limitations were something the motorist and other battery users had to learn to live with. The most obvious one was the need to check the electrolyte level at regular intervals and top it up – ideally with distilled water – when necessary. At best it was a rather messy chore, regarded as part of the price of maximum battery life; at worst it was something honoured more in the breach than the observance, with predictable results.

Then came the first breakthrough, the so-called "antimony-free" plate. Previously, anything up to 10% antimony had been added to the lead from which the plate grids were cast, the antimony providing the necessarv rigidity, which pure lead lacks.

Chloride Australia claim that this picture tells it all! Who, in his right mind would put a battery on the seat of his car and allow his child to play with it? Yet both the seat and the model came through this test unscathed. And it was a "fair dinkum" battery; fully charged and ready to go.

ce free battery

Unfortunately, antimony has a couple of undesirable side effects, one of which is to significantly increase the amount of gas generated at a given charge rate. Another is the tendency for the antimony to "plate out" under certain charge conditions – particularly prolonged float charging – and form a bridge between positive and negative plates.

(This will occur in spite of the separators, the antimony tracking through the porous openings in the separators.)

The search for a substitute produced several candidates; calcium, cadmium, selenium, and sulphur among them. All have been used with varying degrees of success, calcium being one of the more popular ones. And the best of them reduce gas formation by a very significant amount.

Thus was born the "maintenance-free" dream; a battery which would never need topping up during its expected lifetime. In fact, the concept was a somewhat optimistic one. Granted, it is theoretically possible, assuming a carefully adjusted car electrical system, but it is, at best, a compromise. Those manufacturers who were content to claim "minimum-maintenance" were on much safer ground.

A true maintenance-free car battery

Which brings us to the present time and the new Chloride Australia development. This is not just another antimony-free battery of the minimum-maintenance type; Chloride already market a battery of this type, called the "Hassle-free", which they claim requires topping up only each 10,000km.

The new battery really starts where the minimum-maintenance type leaves off; it uses the antimony-free plates – calcium being the substitute – but there the similarity ends. The new battery is different in almost every respect and, instead of being a compromise solution to the gas problem, is a complete solution.

To see how this is achieved let us first consider the "no hydrogen" concept previously mentioned. This is achieved by giving the negative plate, which normally evolves the hydrogen, greater capacity than the positive plate. As a result, the negative plate is never fully charged and so never reaches the gassing stage. This concept is aided by the fortutious fact that a negative plate does not normally evolve hydrogen until much later in the charge than the generation of oxygen at the positive plate.

(This idea of excessive negative plate capacity is not new. It has been used for many years in the highly successful sealed nickel-cadmium battery, and for the same reason. Research into the sealed Ni-Cd battery began in the 1930s.)

With the hydrogen problem solved, there remains the oxygen problem. The chemistry involved here is a little more complex, and is also dependent on the physical design of the battery. In fact, this latter aspect is so important that it might be better to consider it at this time, returning to the oxygen recombination mechanism in a moment.

First, the battery contains no free acid, all the acid being held in special separators clamped between the plates.

This form of construction not only makes possible the oxygen recombination process, but also a "clean" battery concept not previously considered feasible. The battery cannot leak, even if the case is cracked, and will work just as effectively on its side, or upside down. And, the terminals will not corrode.

The separators themselves represent a very important design achievement. They look like thick white blotting paper, but are actually extremely fine woven glass fibres. They are both highly absorbent and acid resistant.

Which brings us back to the oxygen problem. In a conventional "flooded" cell the evolved oxygen simply rises to the surface of the electrolyte as bubbles, with little chance of reaching the negative plate by reason of the conventional separators.

In the new cell the highly porous nature of the separator and its intimate contact with both plates encourages the oxygen to migrate directly through the separator to the negative plate. Here it reacts to form lead sulphate, the same substance produced during the discharge cycle. During the charging cycle, the lead sulphate is changed back to spongy lead and electrolyte.

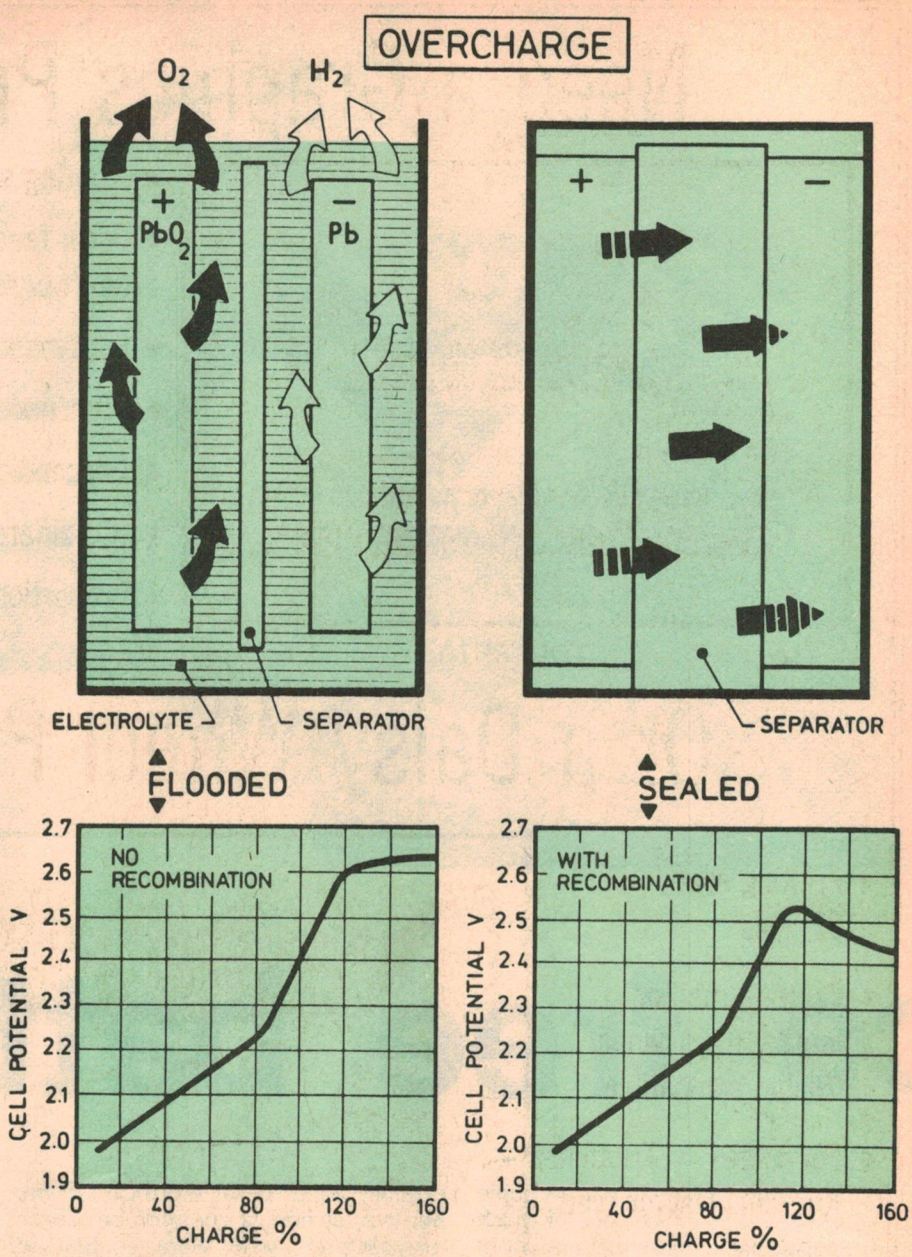
This formation of additional lead sulphate has two results. One, it slows down the charging rate of the negative plate, and thus delays still further the time when this plate could evolve hydrogen. And, two, it provides the mechanism whereby the evolved oxygen can find its way back into the electrolyte.

As a result there is no loss of either hydrogen or oxygen from the electrolyte and the battery functions on a completely closed chemical cycle. This also means that the case can be – and indeed must be – completely sealed; in fact, airtight. Together with the lack of free acid, it makes possible the totally "clean" concept already mentioned.

This chemical concept, and the means to achieve it, is not new. As already mentioned it was first used in the sealed NiCd cell, development of which began back in the 1930s. And for the lead-acid battery, it has been in use for at least 15 years, being inspired by the need for clean, reliable, maintenance-free batteries for satellites.

What is new is the development of such a battery for the domestic automotive market. This is the real breakthrough and, what's more, it is an Australian breakthrough. While the chemistry and associated technology was well known world-wide, no one had considered applying it to an automotive battery or, if they had, worked out a suitable manufacturing process.

It was left to Chloride Australia to develop the manufacturing process; a major undertaking which involved the development of several new manufacturing jigs and machines, devices which exist nowhere else in the world. At the time of writing engineers from other international Chloride companies are due to visit Chloride Australia to investigate the battery and the manufacturing process with a view to introducing it in their countries.



In a conventional cell oxygen from the positive plate rises to the top of the electrolyte and is lost. In the new cell it passes through the special separator to the negative plate and, ultimately, back into the electrolyte.

Having said all that, it is reasonable to ask what penalties in battery performance, if any, have had to be paid for the maintenance-free achievement. In fact, there don't appear to be any; in all respects the battery performs at least as well as a conventional battery and in some important respects a good deal better.

One advantage is the battery's internal resistance. The use of absorbent materials in so-called "dry" lead-acid cells is not new, but the price has always been an increase in the cell's internal resistance. In this case the reverse is true; the internal resistance of these cells is lower than that of conventional lead-acid cells (in fact, the "resistance" of the separators is 100 times lower than for conventional types, according to the makers).

In more practical terms these batteries will crank an engine significantly faster. Tested according to the internationally recognised SAE cold cranking test – at –18°C – this battery developed one volt more than similar conventional batteries; a very significant increase in a nominal 12V system. Even more impressive was the fact that it delivered no less than 400A!

The new battery is also smaller and lighter than a conventional battery of the same capacity. The smaller size is not im-

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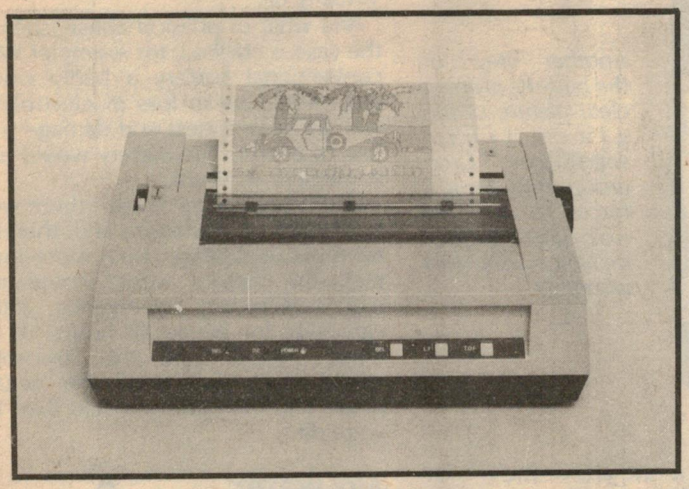

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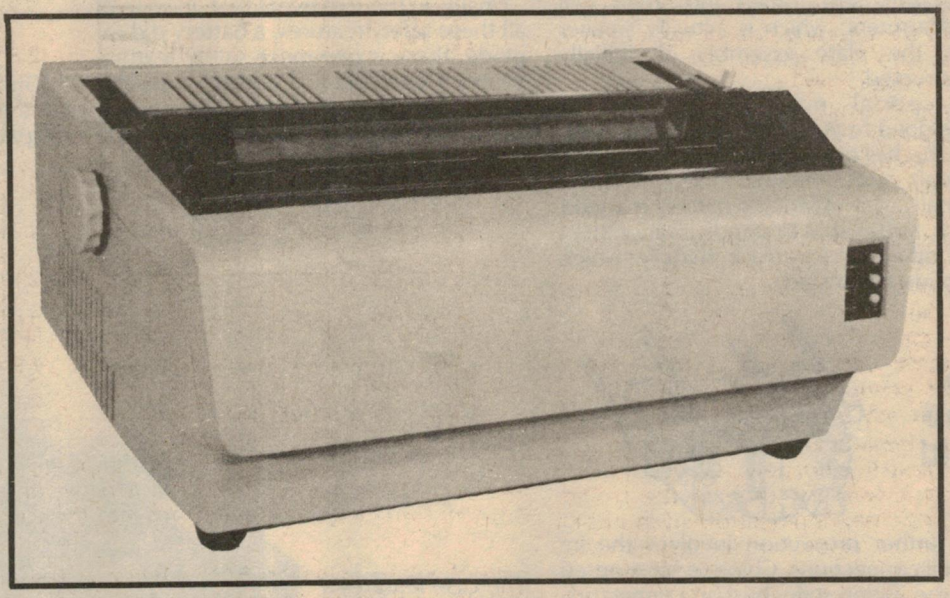

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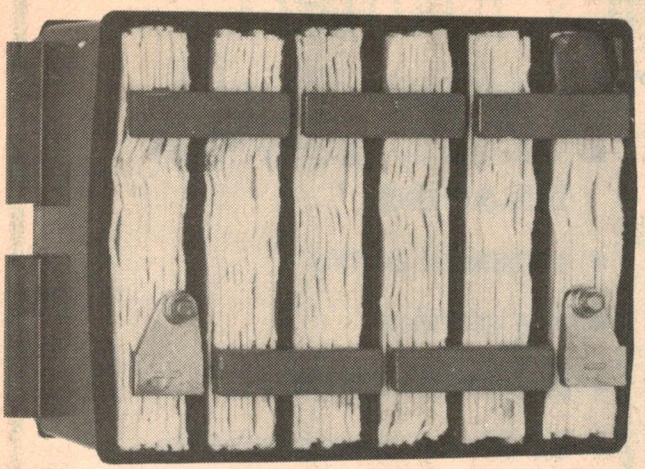
A true maintenance free battery



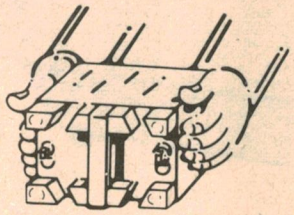
Another view of the battery, giving a clear picture of the glass fibre separators. Each group of plates is a force fit into its compartment, making a very rigid assembly.

mediately apparent, because it applies to the "works" rather than the case, but there is a weight saving of 0.9kg for a typical battery; from 15.2kg down to 14.3kg.

Protection against vibration is another feature of the battery's design. The plates of each cell, and the associated separators, are forced into their cell compartment, which is actually smaller than the plate assembly as initially constructed.

A special machine had to be developed to fit the plates into the case, and this has been dubbed, appropriately enough, "the shoehorn machine". Thus, as finally assembled, the battery is a solid block, better able to stand vibration than any other car or truck battery which Chloride has tested.

No free acid



A further precaution involves the intercell connections. Chloride have opted for the older style busbar connectors, above the plate assembly, even though these are still hidden inside the case. They should be well able to withstand any remaining vibration which reaches them.

Another important feature is battery safety. With no hydrogen being generated, and the oxygen being immediately recombined, the risk of battery explosion is virtually nil. In fact, the negative plates even absorb the oxygen from the air trapped within the case, leaving only nitrogen.

But what happens if the battery is grossly abused; overcharged for several hours? The battery is remarkably tolerant to such abuse but, if the abuse is severe enough, hydrogen will be produced, plus oxygen at a rate above the recombination capability.

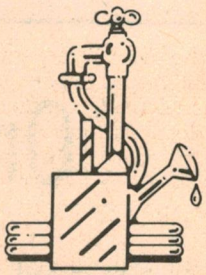
To cope with this there is a safety vent to relieve the pressure, with the further precaution that it is fitted with a Vion disc; a flame proof device which prevents any ignition outside the battery from entering the battery.

Finally, in the rare event that, in spite of all these safety features, a battery did explode, there is one more safety feature. When a conventional battery explodes the major cause of damage or injury is the acid which is sprayed around. With this battery there is no free acid so the risk of damage from this source is, again, virtually nil.

And what of physical abuse, such that the case is cracked, for example? With a conventional battery a badly cracked case would mean loss of electrolyte – with attendant mess and damage – and loss of power. The battery would be an immediate write-off.

With the "Torque Starter" there would be no loss of electrolyte and, therefore, no mess or damage. Even more important, the battery would continue to work, providing emergency starting capability for up to 48 hours. By that time, oxygen from the atmosphere would have discharged the negative plates and the battery would then be a write-off.

No water needed — ever



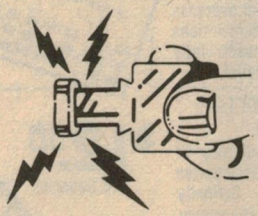
On the other hand, assuming that none of these abuses occurs, what is the anticipated life of the battery under typical

The case features a built-in handle for easier lifting.

motoring conditions? As with any battery, this is almost a "how-long-is-a-piece-of-string" question, but the following points are significant.

The makers are covering the battery with a four year pro-rata guarantee. Guarantees are normally calculated on the basis that average battery life will exceed the guarantee period and, in fact, it is not unusual to find that batteries that are well looked after will last for twice this period, or longer.

Improved performance faster starting



Since the new battery requires virtually no maintenance, apart from ensuring that it is correctly charged, the neglect which destroys many batteries is no longer a factor. So it would be reasonable to expect at least the same average performance, or possibly, better.

Apart from these points the physical design of the battery features a number of improvements which, although not related to the major breakthrough, are nevertheless important from a user's point of view.

First, the terminals have been centrally located, making the battery suitable for either right hand or left hand cable arrangements. This, with other design points, has enabled a single model to suit 65% of cars on the Australian roads. The terminals are designed to accept either spade connections or the standard clamp.

The case features a built-in handle, making the battery much easier to lift. The handle normally sits flush with the rest of the case top, but lifts when in use to provide plenty of knuckle room for large hands.

The battery is also stackable. Circular protrusions on the top of the case, at each corner, mate with matching recesses in the bottom of the case. This is useful not only for storage, but for those applications where a large number of batteries are to be connected together, as in a standby bank. Slots in the case accommodate the interconnecting cables.

So there it is, a battery unlike anything that has been seen in automotive circles anywhere in the world until now. Is it the ultimate solution to the motorists' battery problems? Only time will tell, of course, but, if it does live up to its promise – and it looks very much as though it will – the battery scene will never be quite the same again.

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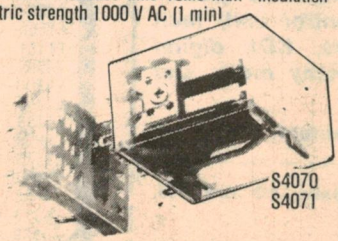
CAT.NO	COIL VOLTS.	COIL RESIST.	CONTACT SET	MAX SW CURRENT	MAX SW CAPACITY	PRICE 1-24	PRICE 25 UP
S4060	12	400	SPDT	1A	100VA	$1.50	$1.25
S4061	12	300	DPDT	1A	100VA	2.00	1.60
S4066	12	400	SPDT	3A	350V	2.00	1.60

RELAYS FROM THE IMPORTER

Cradle relays, pinout compatable with itt and siemens. High sensitivity, high reliability Gold flashed contacts. *Operate time 15ms max *Release time 10ms max *Insulation resistance 100 M OHM at 500 V DC *Dielectric strength 1000 V AC (1 min)

S4067
S4068

SAVE 30%



S4070
S4071

CAT.NO	COIL VOLTS.	COIL RESIST.	CONTACT SET	MAX SW CURRENT	MAX SW CAPACITY	PRICE 1-24	PRICE 25 UP
S4067	12V	325	DPDT	2A	120VA	$4.50	$3.90
S4068	24V	1600	DPDT	2A	120VA	4.50	3.90
S4070	12V	185	4PDT	1A	60VA	4.95	4.50
S4071	24V	700	4PDT	1A	60VA	4.95	4.50

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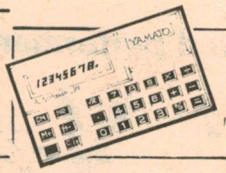

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90c 10 UP 75c

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MPF102	55c	CA3140	$1.25	MEL12 PHOTO DARLINGTON	95c	BUX80	7.95
HF/VHFFET MPF104	50c	BF469	$1.00	LAM3915 LED BAR/DOT DRVR	$3.50	BU208	4.20
						LM317K	2.95
						LM309K	3.50
						TA7205	2.95
						MPF105	50c
						LM339	1.75

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MOSFET BARGAINS

*Audio Power module kit $59.95 (1 channel) *Power transformer $37.50 with copper flux strap *Electro's 8000 MF/75V $9.50 *Mosfet semi's hitachi 2SK134, 2SJ49 $6.00 ea.

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Includes superb finish front panel/heat-sink and every last nut and bold, even solder! FULL INSTRUCTIONS INC.

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Used in the 5000 series preamp

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PC STAKES (PINS) SAVE 33%

Pack 100 (ave)
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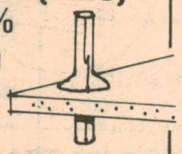

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Dark 200K Light 330 OHMS

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LESS THAN ½ PRICE

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Write for free circuit diagram

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Ideal PCB mount - Momentery 2 pole Push-on Positive "click action" Geat for alarm equip. intercoms, custom keyboards etc.

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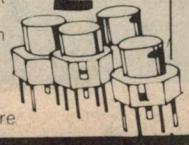

$1.85
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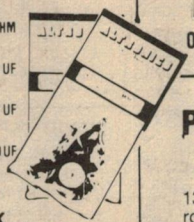

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Listen to Jumbo Jet Pilots AM BAND + MHZ 108 - 174

GREAT VALUE **$24.50**

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It might surprise you to know that we have been one of the largest importers of 8 inch dual cone speakers for some years. We bring them in a container load at a time! Naturally we can better any other price in Australia - just try us for bulk orders.

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ALTRONIC C2000 DUAL CONE 45HZ - 15KHZ Power rating 5W nominal, 10W max. impedance 8 OHM quality Japan manufacture. great for extension speakers. PA's back ground music, car, caravan boat etc.

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VARIABLE/REGULATED POWER SUPPLY KIT
0-32V 1 AMP *uses LM317K IC *full voltage and current metering *overload and short circuit protected *easy to build, full instructions and every last nut and bolt supplied *circuit designed by Electronics Australia.

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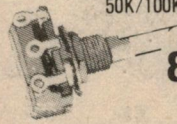
All with ¼ in shafts Linear 500/1K/10K/20K/50K/100K/500K/ 1M/2M Logarithmic 1K/5K/10K/20K/ 50K/100K/500K/1M/2M



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85¢ ea.
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ELECTRET MIC INSERT
includes full circuit and applications sheet.

$1.50 10 UP $1.25
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VELOSTAT SHEETS 150mm x 225mm
Alfoil is out, out, out. There must be 1000's of $$$ worth of CMOS IC's LSI's etc ruined every day thru mishandling and poor storage. This handy 3m product is the answer - you can store literally 100's of IC's on just one sheet.

$3.50

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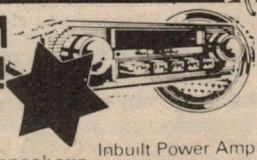
CHANNEL 27.880 fitted Includes carry case - get one for the boat today

$59.95

INCREDIBLE AM/FM CAR STEREO OFFER!



FERRIS TWIN CONE SPEAKERS
10 Watts max. Complete with grills.

69.95
Includes speakers
Inbuilt Power Amp 7 Watts RMS Per Channel

Latest trains move on lines of magnetic

MAGNETIC

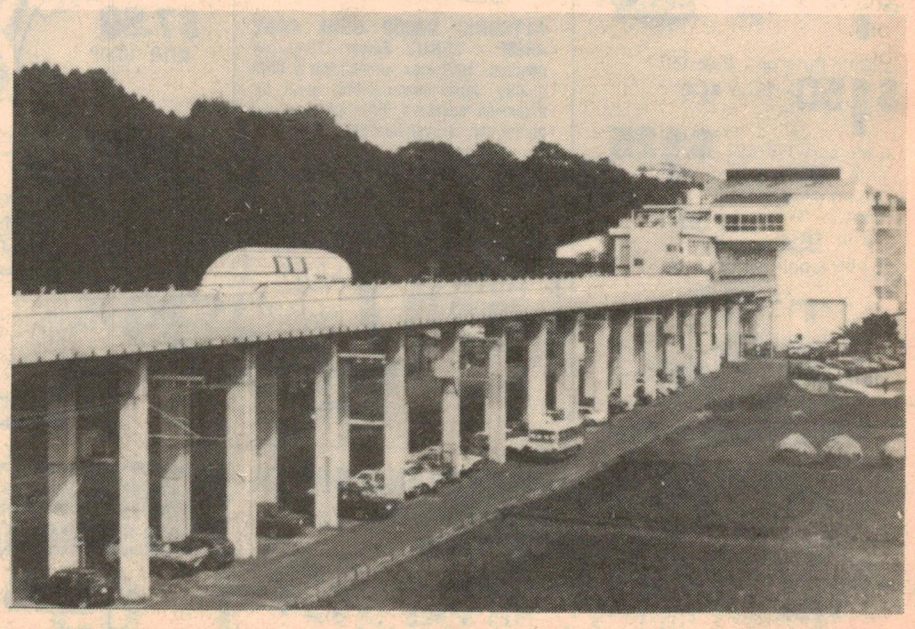
A railway system in which the trains are suspended in the air by magnetic forces is no longer a dream. Experimental magnetically levitated vehicles are already on trial, and may soon carry passengers on regular routes, at speeds of up to 400km/h.

Both propulsion and braking for a levitated vehicle is provided by a linear induction motor, which is rather like a conventional electric motor which has been opened up and laid out flat. Mounted on the bottom of the vehicle is the primary, basically a set of windings laid in slots in a laminated iron block. The second element of the motor is an aluminium "reaction" rail set into the track.

When power is fed to the primary windings, currents are induced in the reaction rail, generating magnetic fields which propel the vehicle. Reversal of the current through the motor windings produces a magnetic drag which brakes the vehicle.

Various types of levitation systems are under development around the world. Most work has concentrated on levitation using superconducting magnets.

Above: the West German Transrapid 05. Results of tests on this vehicle will be used in the design of a high-speed passenger service over distances of 50 to 100 kilometres.



At right is the ML-500R on its test track. On December 21st, 1979 this vehicle set a world rail speed record of 517km/h, propelled by a linear motor.

LEVITATION

In Canada, for instance, work has focused on superconducting magnets working at liquid helium temperatures. One proposed system uses a vehicle levitated by 10 superconducting magnets surrounded by heat-insulating Dewar vessels. The fields produced by the magnets interact with fields induced in guideway conductors formed of aluminium strips to lift the vehicle.

Propulsion is by an air core linear synchronous motor – an array of 49 superconducting magnets mounted along the length of the vehicle. The magnets couple to aluminium cable windings along the top of the guideway. Power for the system is provided by a variable frequency regulated current fed to the guideway windings by converter stations located at 10km intervals along the track, and the levitated vehicle is pulled along at a speed directly proportional to the output frequency of the converter.

One of the most difficult problems is the design of the cryogenic system for the superconducting magnets. Two possible systems are being considered. One involves a complex closed cycle refrigeration system with a helium compressor to supply the superconducting magnet Dewars. The other system uses an on-board helium storage tank above each magnet vessel. Lost gas would be replaced by liquid helium from trackside cooling plants.

If the proposed system is built, it is estimated that the time to travel from Toronto to Montreal (545km) would be about 70 minutes. This compares with a jet aircraft travel time of 60 minutes.

In West Germany work on magnetically levitated rail systems began in 1969 when the Government ordered a study of high-speed, large capacity transport systems. A testing ground near the river Ems is the centre of current research. The test ground consists of a line of track with loops at each end, elevated 5m above ground level, and with a total length of 31.5km.

Japanese National Railways (JNR) began a magnetic levitation project in 1962, and two test vehicles were first run in 1972. In 1974 superconducting magnets were selected for both levitation and propulsion and tests were carried out using the ML-500R vehicle which carried on-board helium refrigeration units to maintain the super-conducting magnets.

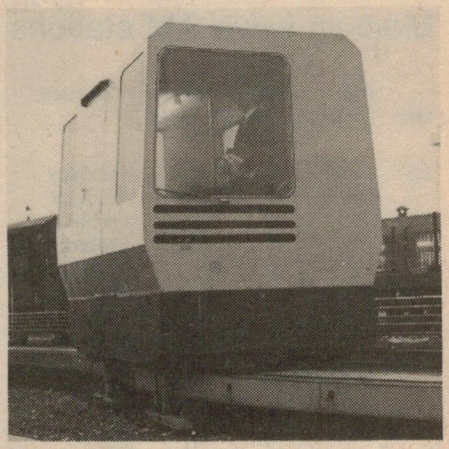
Already known for the "bullet" train, JNR are also among the leaders in magnetic levitation technology, and are aiming to develop railway systems which will be from two to three times faster than any presently existing.

One of the advantages of magnetically levitated railway systems is that there are no moving parts in the suspension or propulsion units. The number of parts which can break down or wear out are greatly reduced, so there is a decreased need for maintenance.

British Rail estimate that the cost of track for a magnetically levitated system is about twice that of conventional track, but maintenance costs may be only a third. Similarly, magnetically levitated vehicles may cost 10 to 50% more than wheeled vehicles, but lack of moving parts could halve maintenance costs.

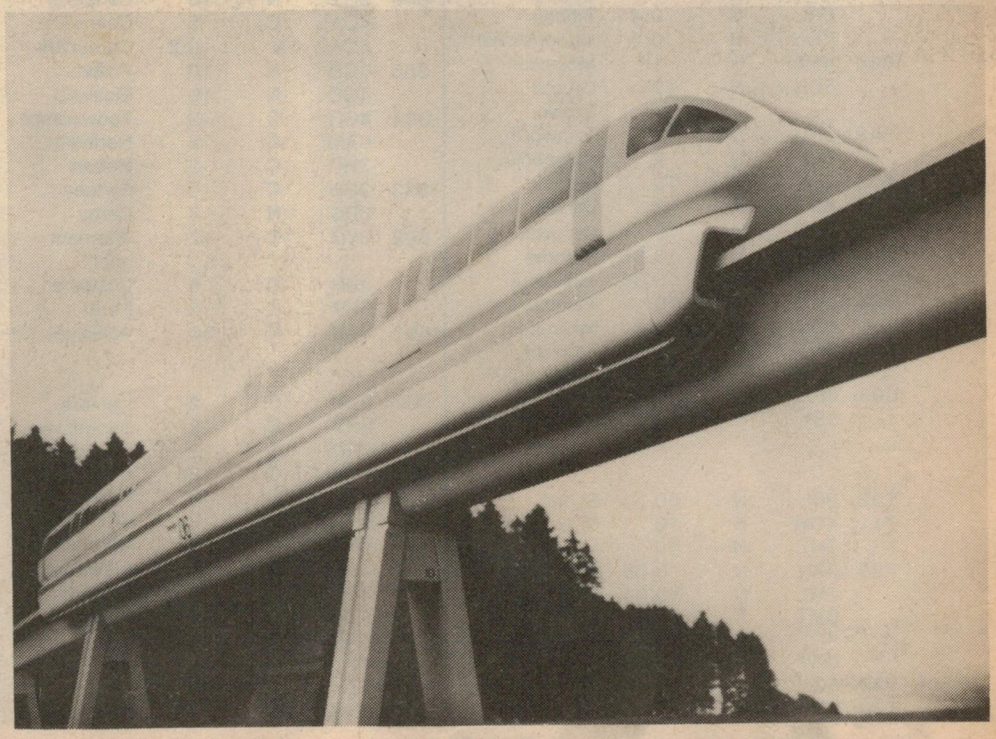
Magnetically levitated vehicles do not rely on friction for propulsion, so they are virtually immune to the effects of snow, rain or ice on the track. The magnetic system is also ideal for exposed sites and elevated tracks.

Energy consumption of a magnetically levitated vehicle is comparable to that of a similar wheeled train, but reduced maintenance costs for vehicle and track may swing the balance.



British Rail prototype maglev vehicle, 3.5m long and weighing 3 tonnes. Built in 1974, the vehicle proved the utility of magnetic levitation on steep gradients and tight curves at the Derby test track.

Below: West German Transrapid 06 test vehicle, due to begin trials this year. The vehicle is 54m long, weighs 102 tonnes and can carry 200 passengers at a maximum speed of around 400km/h.



Australian AM-FM broadcasting services

Medium wave AM stations

kHz	Call (Note 1)	Class (Note 2)	Power (kW)	Location
531	2MC	C	5	Kempsey
	3UL	C	5	Warragul
	4KZ	C	5	Innisfail
	5UV	P	0.5	Adelaide
	6DL	N	10	Dalwallinu
540	4QL	N	10	Longreach
	7SD	C	5	Scottsdale
549	2CR	N	50	Cumnock
558	4AM	C	5	Atherton
	4GY	C	5	Gympie
	6WA	N	50	Wagin
	7BU	C	2	Burnie
567	2BH	C	0.5	Broken Hill
	4JK	N	10	Julia Creek
	6PU	N	0.1	Paraburdoo
	6MN	N	0.1	Mt Newman
	6TP	N	0.1	Mt Tom Price
576	2FC	N	50	Sydney
	2WEB	P	2	Bourke
594	3WV	N	50	Horsham
603	6PH	N	2	Port Hedland
	7ZL	N	10	Hobart
612	4QR	N	50	Brisbane
	6NM	N	0.2	Northam
621	3AR	N	50	Melbourne
630	4QN	N	50	Townsville
	6AL	N	0.4	Albany
	7QN	N	0.4	Queenstown
639	4MS	N	1	Mossman
	5CK	N	10	Crystal Brook
648	2NU	N	10	Tamworth
	6GF	N	2	Kalgoorlie
657	2BY	N	10	Byrock
	8DR	N	2	Darwin
675	2CO	N	10	Corowa
	6BE	N	0.05	Broome
	8KN	N	0.05	Katherine
684	2KP	N	10	Kempsey
	6BS	N	4	Busselton
	8TC	N	1	Tennant Creek
693	4KQ	C	5	Brisbane
	5SY	N	2	Streaky Bay
702	2BL	N	50	Sydney
711	4QW	N	10	St George
	7NT	N	10	Launceston
720	2AN	N	0.05	Armidale
	2ML	N	0.04	Murwillumbah
	3MT	N	2	Omeo
	4AT	N	4	Atherton
	6WF	N	50	Perth
729	5CL	N	50	Adelaide
738	2NR	N	50	Grafton
747	4QS	N	10	Toowoomba
	8JB	N	0.1	Jabiru
756	2TR	N	2	Taree
	4QA	N	2	Mackay
	6KW	N	0.1	Kununurra
765	2BE	C	3.5	Bega
	2BE-T	C	0.5	Moruya
	6KA-T	C	0.1	Paraburdoo
	6KA-T	C	0.1	Mt Tom Price
774	3LO	N	50	Melbourne
	4TO	C	5	Townsville
783	2KA	C	2	Katoomba
	6VA	C	2	Albany
792	4QG	N	10	Brisbane
801	4QY	N	2	Cairns
	5RM	C	2	Renmark
810	2BA	N	10	Bega
	6WN	N	10	Perth
819	2GL	N	10	Glen Innes
828	3GI	N	10	Sale
	4NA	C	5	Nambour
	6GN	N	2	Geraldton
837	3CR	C	0.25	Melbourne
	4RK	N	10	Rockhampton
	6ED	N	1	Esperance
	7QT	C	0.5	Queenstown
846	2CY	N	10	Canberra
	4CA	C	5	Cairns
	6CA	N	0.2	Carnarvon
855	4QB	N	10	Pialba
	4QO	N	10	Eidsvold
864	4GR	C	2	Toowoomba
	6AM	C	2	Northam
	7HO	C	2	Hobart
873	2GB	C	5	Sydney
	6DB	N	2	Derby
882	3YB	C	2	Warrnambool
	4BH	C	5	Brisbane
	6PR	C	2	Perth
891	5AN	N	50	Adelaide
900	2LM	C	2	Lismore
	6BY	C	2	Bridgetown
	7AD	C	2	Devonport
	8HA	C	2	Alice Springs
918	2XL	C	2	Cooma
	4VL	C	2	Charleville
	6NA	C	2	Narrogin
927	3UZ	C	5	Melbourne
	4CD	C	5	Gladstone
	4CD-T	C	0.1	Biloela
	6NR	P	2	Perth
936	4AY	C	5	Ayr
	7ZR	N	10	Hobart
945	3BO	C	2	Bendigo
954	2UE	C	5	Sydney
963	2RG	C	5	Griffith
	4WK	C	5	Warwick
	6TZ	C	2	Bunbury
972	2MW	C	5	Murwillumbah
	5DN	C	2	Adelaide
981	3HA	C	2	Hamilton
	4RO	C	2	Rockhampton
	6KG	C	2	Kalgoorlie
990	6PM	C	2	Perth
	8GO	N	0.5	Gove
999	2NB	N	2	Broken Hill
	2ST	C	5	Nowra
1008	2XX	P	0.3	Canberra
	4IP	C	5	Brisbane
	6GE	C	2	Geraldton
	7EX	C	5	Launceston
1017	2KY	C	5	Sydney
	6WH	N	0.1	Wyndham
1026	3DB	C	5	Melbourne
	4MK	C	5	Mackay
	6NW	C	2	Port Hedland
1044	2UH	N	1	Muswellbrook
	4WP	N	0.5	Weipa
	5PI	C	2	Crystal Brook
1053	2CA	C	5	Canberra
1062	4TI	N	2	Thursday Island
1071	3CV	C	5	Maryborough
	4SB	C	2	Kingaroy
	6WB	C	2	Katanning
1080	2MO	C	2	Gunnedah
	4MI	N	0.2	Mount Isa
	6IX	C	2	Perth
	7HT	C	5	Hobart
1089	3WM	C	5	Horsham
	2GZ	C	5	Orange
1098	4LG	C	2	Longreach
	6MD	C	2	Merredin
	7LA	C	2	Launceston
1107	2UW	C	5	Sydney
1116	4BC	C	5	Brisbane
1134	2AD	C	2	Armidale
	3CS	C	5	Colac
	6CI	C	2	Collie
1143	2HD	C	2	Newcastle
1152	2WG	C	2	Wagga Wagga
1161	4MB	C	2	Maryborough
	5PA	N	10	Naracoorte
	7FG	N	1	Fingal
1170	2CH	C	5	Sydney
	4GC	C	0.1	Charters Towers

kHz	Call (Note 1)	Class (Note 2)	Power (kW)	Location
1179	3KZ	C	5	Melbourne
1188	2NZ	C	2	Inverell
	6XM	N	2	Exmouth
1197	4GG	C	5	Gold Coast
	5KA	C	2	Adelaide
1206	2CC	C	5	Canberra
	2GF	C	5	Grafton
	6KY	C	2	Perth
1215	2ST-T	C	0.35	Bowral
1224	2WS	C	5	Sydney
	3EA	S	5	Melbourne
1233	2NC	N	10	Newcastle
1242	3TR	C	5	Sale
	4AK	C	2	Oakey
	5AU	C	2	Port Augusta
	8DN	C	2	Darwin
1251	2DU	C	2	Dubbo
1260	3SR	C	2	Shepparton
	6KA	C	1	Karratha
1269	2SM	C	5	Sydney
1278	3AW	C	5	Melbourne
1287	2TM	C	2	Tamworth
1296	4BK	C	5	Brisbane
	5SE	C	2	Mt Gambier
1314	2WL	C	5	Wollongong
	3BA	C	5	Ballarat
1323	2GO	C	5	Gosford
	5AD	C	2	Adelaide
1332	3SH	C	2	Swan Hill
	4BU	C	5	Bundaberg
1341	2NX	C	5	Wallsend
	3GL	C	5	Geelong
1359	2LF	C	2	Young
1368	2GN	C	2	Goulburn
	4LM	C	2	Mt Isa
1377	3MP	C	5	Melbourne
	8AL	N	2	Alice Springs
1386	2EA	S	5	Sydney
	5AA	C	5	Adelaide
1395	2LT	C	5	Lithgow
1404	2PK	C	2	Parkes
1413	2KO	C	5	Newcastle
1422	3XY	C	5	Melbourne
1431	2WN	N	2	Wollongong
1440	2CN	N	2	Canberra
1449	2MG	C	5	Mudgee
1458	2NM	C	2	Muswellbrook
	5MU	C	2	Murray Bridge
1467	3MA	C	2	Mildura
1476	2KA-T	C	0.5	Penrith
	4ZR	C	2	Roma
1485	2LG	N	0.2	Lithgow
	4EB	P	0.1	Brisbane
	4HU	N	0.05	Hughenden
	5LN	N	0.2	Port Lincoln
	2EA	S	0.1	Wollongong
1494	2AY	C	2	Albury
1503	2BS	C	5	Bathurst
	8AK	C	5	Melbourne
1512	2NA	N	10	Newcastle
1521	2QN	C	2	Deniliquin
1530	2VM	C	2	Moree
1548	4QD	N	50	Emerald
1557	2RE	C	2	Taree
1566	3NE	C	5	Wangaratta
	4GM	N	0.2	Gympie
1575	200	C	5	Wollongong
1584	2WA	N	0.1	Wilcannia
	5MG	N	0.2	Mt Gambier
	5WM	N	0.05	Woomera
	7SH	N	0.01	St Helens
	2EA	S	0.1	Newcastle
1593	4SO	N	0.2	Southport
	5MV	N	2	Renmark
1602	2CP	N	0.05	Cooma
	5LC	N	0.05	Leigh Creek
	3WL	N	0.2	Warrnambool

AM repeater stations

Call of Parent Station	Location	kHz	Power (kW)
2BE	Moruya	765	0.5
2KA	Penrith	1476	0.5
2ST	Bowral	1215	0.35
4CD	Biloela	927	0.1
6KA	Paraburdoo	765	0.1
6KA	Mt Tom Price	765	0.1

Notes

1 T Translator
2 N National
C Commercial
P Public
S SBS

FM broadcasting stations

MHz	Call Sign	Power (kW)	Location
92.1	6UVS	5	Perth
	7CAE	1	Hobart
	5ABC	10	Adelaide
92.3	2ARM	0.1	Armidale
	2MCE	1	Bathurst
	3EON	10	Melbourne
92.5	2NCR	3	Lismore
92.9	6NEW	0.25	Newman
	2ABC	50	Sydney
	5EBI	4	Adelaide
93.3	6ABC	60	Bunbury
	7ABC	120	Launceston
93.7	3MBS	4	Melbourne
	5MMM	4	Adelaide
93.9	7ABC	15	Hobart
96.1	6NOW	10	Perth
97.5	6ABC	50	Perth
101.9	3FOX	10	Melbourne
	1ABC	50	Canberra
102.1	8CCC	0.125	Alice Springs
	4ZZZ	6	Brisbane
102.5	2MBS	10	Sydney
102.7	3RRR	10	Melbourne
	4DDB	2	Toowoomba
103.2	2CBA	5	Sydney
103.3	4MBS	2	Brisbane
	7HFC	1.5	Hobart
103.5	3GCR	0.1	Churchill
103.7	2NUR	3	Newcastle
104.1	8TOP	10	Darwin
	2DAY	35	Sydney
	4MMM	6	Brisbane
	5ABC	150	Mt Gambier
104.9	2MMM	35	Sydney
105.3	3ABC	50	Ballarat
105.7	3ABC	50	Melbourne
	2JJJ	10	Sydney
106.1	2ABC	25	Newcastle
	4ABC	50	Brisbane
107.5	2SER	4	Sydney
	5SSA	5	Adelaide
107.7	3PBS	0.2	Melbourne
107.9	2REM	0.3	Albury

FORUM

Conducted by Neville Williams

We cop a blast on power stations and digital audio recording

Just when everything seemed quiet and calm, I suddenly find two NSW readers gunning for me. One is quite upset about my treatment of the power crisis in NSW, in the October issue. The other objects to what I said — or didn't say — about digital audio recording in the November issue. Let's look at this one first.

As you might remember, the article in the November issue was headed "Digital recording sparks off a resistance movement." It made the point that while the digital system is being widely accepted around the world by hardware and software manufacturers alike, a very vocal minority of audiophiles is crusading against it, here and elsewhere.

However, N.C. of Ryde NSW found my remarks not to his liking.

Dear Neville,

I am surprised and shocked after reading Forum in the November issue. You seem to have taken Douglas Sax's remarks seriously.

Usually Forum is a source of profound enlightenment to us all. This time you have let us down badly; this time Forum was virtually a confession by you that you know very little about A/D-D/A theory or practice and at present you can only question rather than refute Sax's statements.

Since this seems to be an important future topic, I suggest you find out the background quickly. You can do worse than start at the "Six db of erasure and it's gone." That phrase alone indicates either total ignorance or deliberate misrepresentation.

In the same issue, I question your publication, on page 84, of a design for a "Video Summing Amplifier". To obtain a useful performance, a circuit design alone is useless without a PC layout, since strays are critical.

I trust you find these comments useful.
N.C. (Ryde, NSW)

Let's put this whole thing in context:

In my introductory remarks, in the November issue, about the anti-digital "resistance movement," I pointed to the difficulty of debating, proving or disproving purely subjective observations about sound quality. The panel on page 29 shed further light on this aspect.

But, having made those remarks, I proceeded to exercise another option that one often has in such a case — namely to examine their statements as a whole in an effort to assess the contenders' general approach and credibility. In the act of so doing, I tried to encourage readers to make their own judgments, while leaving little doubt about my own position:

"I have found their arguments open to considerable query . . . a certain familiar ring but a quality that I find less than convincing."

"Does it now?," and so on.

I also pointed to the implications that would follow, if Doug Sax and his friends were right: a huge number of audio engineers around the world would have to be seen as extraordinarily gullible or extraordinarily remiss in their professional obligations.

Presumably, N.C. is not satisfied with this kind of deduction feeling, rather, that I should have come straight out and made a firm and authoritative (?) judgment on each statement.

It would be very nice to be able to do so but that kind of authoritative judgment can really only come from those who are working with the medium and who have the opportunity to subject the allegations to fully instrumented evaluation.

Over and above the basic argument about quantising distortion (subjectively audible or not?) are dropouts a real hazard in quality, virgin tapes? Do errors accumulate significantly (whatever that means) in second and third generation copies ("it becomes a total joke and unlistenable")? Does the effect of storage and/or the loss of 6dB in level really render the recording valueless ("it's gone")?

Frankly, as a matter of first-hand experience, I do not know the answer to those questions. If that's a confession, so be it, but it stands as an open invitation to anyone who may be able to say "I've measured those things and here are my findings."

Looking specifically at the allegation about loss through erasure, I can assure N.C. that I didn't make it up. Here is the full par which Doug Sax chooses to pass on in his article in "Absolute Sound":

I said: "That's one thing I will give you to digital. In a year it'll sound just as bad as it does today."

This guy looks at me and says: "Don't be so sure." He says: "Six dB or erasure and it's gone." He turned out to be the tape designer for 3M and he says: "We'll see how well it holds up in a few years."

Six dB in an environment of magnet structures, oxides coming off, and . . . this ain't much folks.

I stick by the remark which I made immediately after that statement in the November issue and I also stick by the judgment which it implies — even though Leo Simpson also wanted me to be more outspoken in the first instance. I said:

"I am not in a position to say that Doug Sax and his companions are right or wrong but, if he's right, then thousands of his fellow engineers are being incredibly naive. And a clutch of them are being incredibly unenterprising in passing up the opportunity to publish a shattering, fully documented paper nailing the audio industry's biggest ever lie."

Maybe the nail should be turned the other way round!

Just by way of passing interest, I have recently been preparing an article for the February issue of our associate publication "VideoMag." One of the problems being faced by the motion picture industry is the impermanence of multi-dye type colour films and their tendency to fade after a few years. Prints can be replaced but, once the colour negatives fade, that's the end of the picture.

There has been some talk of replacing film negatives with high definition colour video tapes and, indeed, companies like Sony have been working on high definition video systems with this objective in view. But even top quality magnetic tapes must have some limitation on their life and they may only serve as an intermediate medium.

The hot tip seems to be that, if we are to preserve audio/visual material for posterity, the most long-lived medium may well turn out to be the laser-optical glass disc.

So to the final point in N.C.'s letter: the circuit diagram of a video summing amplifier. We agree that a PC board pattern would have made it more complete but, the information was just not available. We copied it, as was, from "Wireless World."

POWER STATIONS

So to the second letter on the subject of power blackouts in NSW. In this case the correspondent specifically requests that he not be identified in any way, and we respect that request. But he is very uptight about the whole thing, as will be apparent from the opening paragraphs of his letter.

I have been reading your magazine for so many years that I prefer not to count them. Could it be 30? Or more? I owe a great deal to your excellent publication for the part it has played in keeping me informed and up-to-date in matters electronic.

I am compelled to write to let you know that, wittingly or unwittingly, you have joined the ranks of uninformed sensation-seeking irresponsible journalists who plague our media to-day.

Neville Williams' article was obviously written from second-hand or worse information, that had its origin in uninformed poorly researched sensation-seeking journalism. One of the problems of our media nowadays is its availability to nut-cases, malcontents, failures, pressure groups, in fact anybody who will say something colourful or controversial. The media eagerly publishes the garbled blabbering of all these people — I think the journalists know that if they researched much of this rubbish they would find that they would not have a story to print, or, at least would have a very ordinary story.

Surely Neville Williams knows all this, yet he got sucked in, and copied a whole bucketful of bull. Worse, he allowed his own uninformed imagination to run riot, and embellished it!

First let me say that I was not at all surprised to receive this letter, nor was I angry about its opening gambit. There was no secret, in the first place, about the source of the story or its speculative nature. It was all part of a serious but incredible charade that prompted the tongue-in-cheek Alice in Wonderland Treatment in the October "Forum."

As you might remember, there had been blackouts in Victoria, which prompted a statement from NSW Government sources — then facing an election — that nothing like that would be likely to happen in this state.

Except that it did, in a very obvious way and at the most inopportune time — to the dismay of the Government and the delight of the Opposition parties.

DUCKING FOR COVER

Naturally, and quite legitimately, the media started asking questions, only to be faced by politicians and supply authorities ducking for cover in all directions. If any frank statements were made, during the period, it would have been difficult to distinguish them as such from the welter of simultaneous assertions, accusations. P.R. releases and "confidential" tales that were fed to journalists.

From references elsewhere in our correspondent's letter, our correspondent evidently sees this as no real problem. Members of the public, he says, can visit power stations by arrangement (no one asks whether they are journalists) and can carry away as much information as they can absorb in a couple of hours.

It would appear, however, that things weren't quite as simple as this for Christopher Jay, Author of the series in "Financial Review" which prompted the

The inside story of a major generator breakdown

Let's look at the Vales Point No. 5 failure referred to in the article.

About 5000 wires run from the control panel to the control logic cubicles — a room full of steel cabinets each housing a number of racks filled with printed circuit boards.

The solid state equipment relays commands from the operator to the various field devices — switches, dampers, valves, etc. The equipment ensures that items are operated in the correct sequence, eg start lube oil pump, start power oil pump, start cooling fan, check oil pressures are correct, close discharge damper, check inlet damper open, start main motor, open discharge damper, etc.

In some instances, this solid state logic control equipment shuts down plant items when vital conditions are unsatisfactory, such as low lube oil pressure; or it starts a standby pump if the duty pump fails.

Another complex array of solid state equipment deals with analog control. This equipment, which is under the operator's control, continuously monitors pressures, temperatures, flows, levels, speeds, oxygen content of flue gas, etc, and modulates valves, dampers, speed controllers and so on. It takes three months to train an operator with 10 years experience behind him to understand a new power station, and he goes on learning for a long time after that!

The solid state equipment of Vales Point requires some hundreds of amps at 24 volts DC to power it, the power supply cubicles being 2 metres high and 7 metres long.

There are two incoming 415 volt AC supplies drawn from different parts of the station auxiliary system. Automatic change-over contactors operate if one supply fails. Transformers and rectifiers convert this to 24V DC and this is distributed to the solid state equipment, using a separate cable individually fused for each cabinet.

As a back-up supply, there are two banks of inverters, running off separate supply cables from different banks of 110V station batteries. The normal and the standby 24V supplies are permanently connected, each through a diode, so that if one supply fails there will be no interruption during change-over. The solid state control equipment is designed and tested not to malfunction if the 24V supply voltage drops as low as 17V. How could it fail?

When the system short-circuit occurred at Munmorah, the sequence of events in the next few seconds was predictable in almost every case, except for the Vales Point No. 5 tragedy.

The operator on No. 5 was faced with an extraordinary situation. Not only had his unit tripped, but the whole control panel seemed to be a mass of flashing lights. Flashing lights indicate that valves, dampers, switches, etc, are moving to new positions or control circuits have changed mode.

His problem was that there seemed to be many more than usual. The mystery was that everything that had been on automatic had reverted to manual control — but it takes the human brain some time to analyse that amongst all the other indications, and

continued overleaf

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"Forum" article. Routine "outage" or breakdown reports were accessible for inspection, but not the one in which he was interested: "the one which eventually led to the blackouts of June 10, 1981." He had to piece together a story as best he could from the information available.

Either that, or drop the whole thing, which would probably have pleased the authorities no end!

Following publication of the Christopher Jay series in "Financial Review," the State Electricity Commission took out a full page advertisement in that journal, ostensibly to answer the allegations with "facts."

Whether the facts did much to illuminate the truth was open to some doubt, becoming the subject of still further argument!

Subsequent to the publication of the "Forum" article, I had a few calls from readers, including a couple from within the SEC. In the latter case, the callers were quite guarded in what they said and anxious not to be identified. I don't criticise them for this but mention it merely to make the point that communication about awkward questions was — and is — distinctly inhibited.

One caller pointed out that 660MW generators were "monsters" only in the relative sense. The Commission might well have been much more adventurous and set its sights on units with up to twice that rating.

Fair enough but nowhere in the article did I criticise the choice of 660MW units, any more than I did the use of Jumbo jets. The whole thrust of the remarks was that, with increasing dependence on fewer and larger units, it becomes just that much more important to safeguard the operation of those units with adequate control, be it automatic or manual.

> And on the very day we laid out this page, the NSW Government announced that all four 500MW units at the Liddell power station would be out of service for various periods. That makes the Vales Pt episode look like a picnic!

Another caller commented on the reference to the mishap at Wangi, 20 or more years ago. It happened he said, but it wasn't all that spectacular. However, I was told, the full bit, with shattered superheated steam pipes, did happen in the U.K.

In another conversation, I was assured that computers do not directly control major items of equipment in power stations; that stage has yet to be reached. Computers are used only for monitoring. Equipment control is currently effected in imposing arrays of racks containing electronic equipment, relays, &c, which sense and react automatically to conditions within the plant.

After a few minutes of conversation along this line, I put to the caller the proposition that the control system he was describing was, in effect, a computer system — Albeit in hard-wired form. Moreover, it was "programmed" to react in certain ways to certain situations. As such, it was as much open to comment as a computer of more contemporary design — including the desirability of having a training simulator.

He seemed to ponder for a while before agreeing that what I had said was probably quite true.

And that brings us to the rest of the most recent letter, in which the correspondent gives his version of what happened at the Vales Point power station. He speaks as one who has an inside knowledge of what went on and who therefore may be well able to pick holes in the newspaper report and my remarks which flowed from it.

As an engineering report, the newspaper article would have been totally inadequate but, as a layman's account of the drama and the implications which accompanied the failure of the Vales Point unit, I doubt that it deserves the description proferred by our correspondent — especially as it had to be deduced from non-information. I venture to suggest that, if all the details in Christopher Jay's original article were brought into line with engineering fact, as seen by our correspondent, the main thrust of the original article would still apply.

But we've said enough.

The contents of the letter are far too long to reproduce in full but the precis in the accompanying panel should give a brief close-up of a problem in a power house.

A major generator breakdown — continued

even longer to realise every detailed consequence.

The operator performed well, doing the things he had to do.

An assistant operator began checking the mass of flashing lights on the control board. He started at the right hand end of the panel, checking item by item and ensuring that plant was in safe condition.

Another assistant operator grabbed a Turbine Security Job Sheet, a list of items which must be checked in any emergency shut-down, and proceeded to check it off, step by step. One of the items on that sheet requires the operator to check the status of the turbine lube oil pumps, because as the turbine speed reduces, the output of the shaft-driven pump becomes inadequate.

The items before the checking of the oil pumps took too long, however, and by the time this operator got to this set of controls at the left hand end of the Unit Subsidiary Board, the other assistant working his way along this board had just about reached the same point. Horror of horrors! All the pumps were on MANUAL control. One of the assistant operators started a pump, but too late! The bearings were already too far gone — melted.

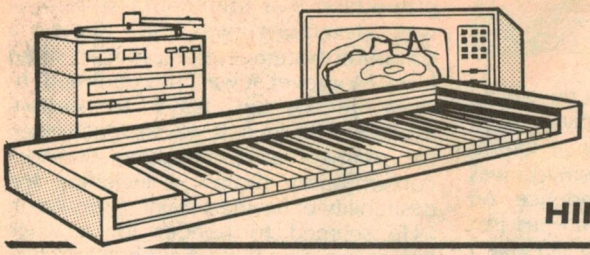
In fact, the starting of the pump almost brought further tragedy, because the hot metal set fire to the oil and a cloud of smoke issued from the bearings. The operators could not see that from the control room, and did not know about it until some eyewitness reported it. The fire was very brief. This is what gave rise to the madly exaggerated fantasy about the end of the turbine turning black.

Why were the pumps not on AUTO? It turned out that the power supply for the solid state equipment, with its back-ups behind back-ups, was the culprit. When the AC power failed for a few cycles, the 24V DC load was taken up by the back-up inverters, which are running continuously day and night just waiting for this moment.

However, these inverters have inbuilt voltage regulators, and voltage regulators take a finite time to act. When the load was thrown onto the converters the output voltage dropped below 17 volts for a few milliseconds. This was just long enough for the flipflops in the logic cards to flop. So a very large number of control circuits which had been set in some mode changed to a different mode — generally following fail-safe practice of falling back to a less sophisticated mode — like MANUAL.

Vales Point No. 5 was the first unit to employ such sophisticated circuitry, and we have now gone back to hard-wired auto-start circuitry for turbine emergency oil pumps. One cannot take them off AUTO from the control room — which may even eliminate some human error.

What was the computer doing at the time? Churning out an unbelievable number of alarms, including messages about oil pumps not being on AUTO, and oil pressure being dangerously low. The humans involved could not digest all the information in the short time. Perhaps, in this instance we would have been better off if we had relied upon that naughty software which is practically never mentioned in outage reports.



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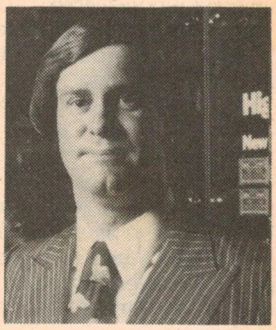
BLANK TAPE LEVY: Industry body calls for public inquiry



Paul Wilcock, Chairman of the AATVA

While video cassette recorders are selling so fast in Australia that they are in short supply, the copyright situation in regard to audio and video taping remains as contentious as ever. One thing now seems certain: there are not going to be any quick and easy solutions.

We had a good look at the copyright situation in the June '81 issue and, as we observed recently in "Forum", the basic situation has not changed much since then.

While copyright owners were claiming quite comprehensive rights to the material involved, it was possible to advance a variety of arguments which tended to erode those rights. Looking ahead, one could see a long period of uncertainty, likely to be resolved only by protracted and costly litigation.

By way of example, we mentioned the decision of a US District Court by which Universal City Studios Inc. failed in an attempt to restrain the Sony Corporation from marketing their Betamax VCRs in the USA. It was anticipated that the case would be subject to appeal, or would trigger clarification by legislation, but the decision remained in force. On the strength of it, Sony and other major manufacturers have since built a huge industry around the domestic VCR.

Now, two years and billions of dollars later, that vital District court decision has been overturned and two huge interests — video hardware and video software — must inevitably be wondering where they go from here; who proceeds against whom, and on what grounds.

It was against that potential — and now real — background that I rounded off the June article with the following conclusion:

"Right at this moment, I can't help but feel that a small levy on the price of blank tapes would be the most equitable solution.

"And by 'small', I am talking about a few percent.

"It would be worth that to be able to do our own thing at a private level without pangs of apprehension, guilt, remorse, conscience, or whatever."

Perhaps predictably, that compromise proposition came under immediate fire on at least three grounds:

- Copyright owners objected to the use of the word "small". If there was to be a surcharge, it would need to be substantial.
- By implication, a surcharge would give access to all copyright material. That might not be acceptable to all copyright owners.
- Many tape users would object in principle to paying a levy, particularly a substantial one, on tape which was not to be used for copyright material.

This last-named group has found strong support from suppliers of blank tapes, both video and audio. They have formed themselves into an association under the title letters AAVTA, and have issued a press statement over the name of their Vice-Chairman and Spokesman, Peter A. G. Rose.

The text of the release is as follows:

AAVTA STATEMENT:

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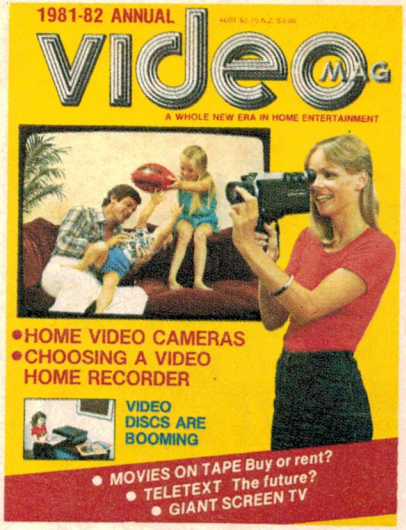

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An "Electronics Australia" publication

Tape Association (AAVTA) is urging a public enquiry on this whole subject.

AAVTA represents the magnetic tape industry with member companies including 3M, TDK, Ampex, Greencorp, BASF, Fuji, Maxell and Agfa.

AAVTA believes that consumers are likely to be forced to pay the penalty of heavy levies on all audio and video cassettes, if proposals suggested by representatives of the Australian Copyright Council, in a lengthy report recently presented to the Attorney-General's Department and at a Symposium on October 1st and 2nd at the Opera House on "Copyright and Technology", received Government approval.

The Australian Copyright Council is partly funded by the Commonwealth Government through the Australia Council and the great majority of its members are copyright owners or their representatives. AAVTA believes that this funding makes it inappropriate for the Attorney-General to refer to the Copyright Council as "a non-Government specialist committee", and points out that no consumers or consumer groups are represented on the Council to provide the Government with a balanced input for the proposed copyright review.

To date, much of the arguments of copyright owners and the record industry hinge on claims, completely unsubstantiated by facts or figures, that they have suffered substantial losses directly attributable to the ability consumers now have through new technology to easily re-record copyright material.

AAVTA firmly believes, however, that copyright owners have benefited enormously from new technology in that it has given them a far wider audience and medium for propagation of their work. An AAVTA spokesman says that any proposals which seek to discourage private recording by the imposition of a penalty or levy would have an opposite and limiting effect upon the popularisation of works, a goal so zealously pursued by the recording industry, live performers and copyright owners alike.

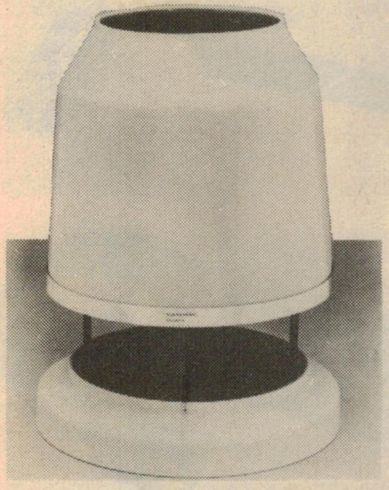
It is also significant that similar attempts to impose levies on blank tapes have been made in other countries, and no country with British law has introduced legislation which provides for a levy on goods where it might be possible to breach copyright.

In the UK, in its long awaited Green Paper on copyright reform, the Government says it has received no convincing evidence that a levy on audio or video hardware or on blank tapes should be introduced. It goes on to say the Government would hesitate at imposing this on the public especially since the imposition of a levy would involve "rough justice", with many tape users who do not

NEW CASSETTE DECKS FROM MARANTZ

Marantz (Australia) Pty Ltd have released a complete new range of golden fascia cassette decks retailing from $179 to $699. All models are metal compatible, all use DC servo motors for constant speed, and all have soft-touch controls, with two incorporating microprocessor logic. All are suitable for unattended recording, using an external control clock, but models SD8020 and SD9020 have timer clocks in-built. The SD3030 (four from top) includes both Dolby B and Dolby circuitry. For further details: Marantz (Australia) Pty Ltd, 19 Chard Rd, Brookvale, NSW 2100. Phone (02) 939 1900.

Outdoor loudspeaker



You might wonder what this is — standing on the patio, near the BBQ or beside the pool. Well, it's Tandy's new MC-900 outdoor omni-directional loudspeaker. Measuring 445mm high and 330mm in diameter, it can handle 50 watts of full-range sound. RRP is $129.95. It is available from all Tandy stores.

record copyright material having to pay.

AAVTA does not endorse piracy of copyright material which involves systematic illegal duplication for financial gain. However, the main use of home video recorders and tape decks is to "time shift" and be able to watch and listen to programs at a more convenient time than when they are broadcast.

AAVTA believes that single copying of this nature for private and domestic use is no more an abuse of the rights of copyright owners than is the current trend towards the legitimate use of home video films rather than Super-8 home movies, and the sending of privately recorded audio cassettes rather than letters.

AAVTA believes that neither of these quite reasonable practices should be penalised by the imposition of a blanket tax or levy on all cassettes.

Copyright Acts in all countries which are contracting parties to international copyright conventions, like Australia, permit overseas governments reasonable freedom to set their own laws regarding what constitutes valid non-infringing use for private and domestic purposes, or for the purposes of education and research. AAVTA believes that now is the time for the Commonwealth Government to legalise single copy domestic use that does not result in any financial gain for the consumer and believes that copyright owners will not suffer if this is done.

AAVTA points out that there are many other complex issues which must be considered in relation to the proposed amendments to the audio visual copyright. All of these issues vitally affect the consumer and must be debated publicly, rather than be considered on the basis of a minimal number of written submissions by non-representative bodies such as the Copyright Council, whose stance on the subject amounts precisely to the type of "rough justice" rejected by the UK Government only a few months ago.

The Association believes that the Attorney-General's Department is not the appropriate medium for a balanced investigation. It believes that a public hearing should be arranged, preferably along the lines of an I.A.C. Enquiry.

For further information: Mr Peter A. G. Rose,
Vice-Chairman and Spokesman,
Australian Audio-Video Tape Assoc.
c/o 3M Australia Pty Ltd,
950 Pacific Highway,
PYMBLE, NSW 2073.
Telephone: (02) 498-0033.

In a separate statement, Paul Wilcock, Marketing Manager of TDK

Professional video from GEC Electronics

The Electronics Division of GEC have a number of new items in the range of professional video equipment which they distribute on behalf of National.

Included are units in the new "9000 Series" 19mm video cassette decks (U-Matic format) which have been engineered to broadcast standards. The NV-9210 (right) is a general purpose deck while the NV-9240 is envisaged as a studio master recorder. The NV-9400 is suitable for portable use, while the NV-9600 is an editing recorder, normally used in association with the NV-A960 editing controller.

Pictured below is a new NV-8050 time lapse recorder. It uses 12.7mm tape in a VHS cassette and replaces the open reel machines formerly used. It can be programmed to record in real-time (two hours) or in up to six time lapse modes.

The remaining item illustrated above is an automatic search controller, for use with VHS recorders. It can encode up to 64 segments of a tape so that individual items can be selected. (Details from GEC Electronics Division or through Concise Communications, 488 Jones St, Ultimo, NSW 2007.

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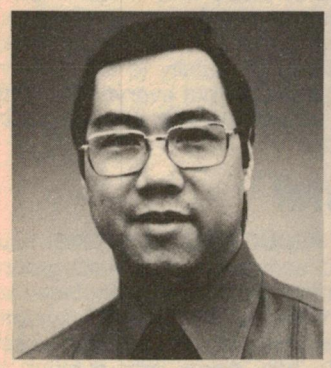
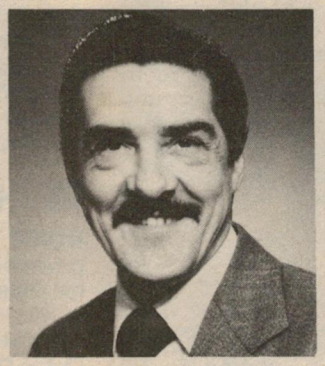


AIWA®

William Lam
Marketing Manager
Aiwa Australia Pty. Limited

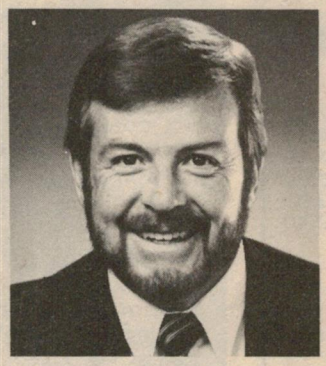
"We recommend TDK cassettes as they compliment the fine bias adjustment that all current model AIWA tape decks are equipped with, enabling optimum recording results."



KENWOOD HI-FI

Reg. J. Hall
National Sales Manager
Trio-Kenwood (Australia) Pty. Ltd.

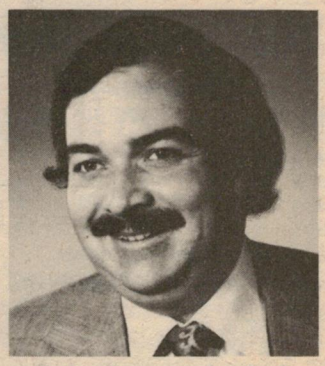
"TDK tape is consistently accurate in quality reproduction, to the degree of being classified by Kenwood as our reference standard."



marantz®

Ted Fawle
Managing Director
Marantz (Australia) Pty. Limited

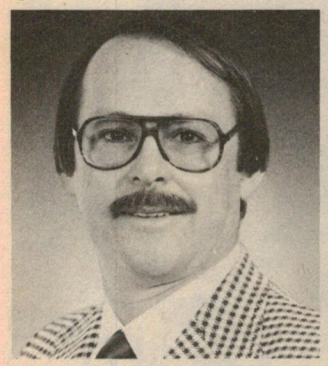
"The combination of Marantz two-speed cassette decks and TDK tape provides a new dimension in home recordings comparable to professional performance standards."



Nakamichi

Geoff Matthews
Marketing Director
Convoy International Pty. Ltd.

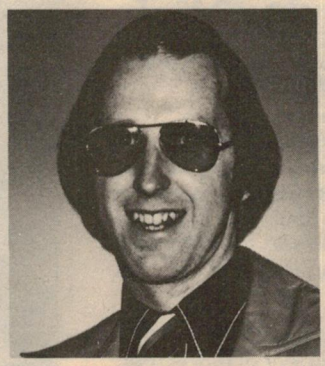
"We recommend TDK for Nakamichi cassette decks for two reasons. The first, for sonic performance and second, for the precision engineered, high stability cassette housing."



OPTONICA

Geoff J. Muir
National Manager
Sharp Corporation of Australia Pty. Ltd.

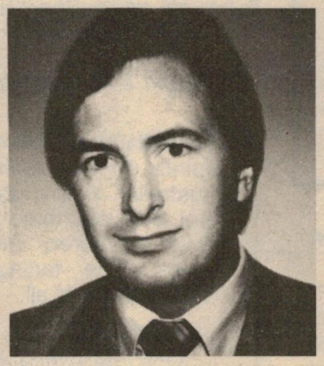
"We at Sharp believe that TDK tapes add to the performance of our tape decks; you should have this improvement also."



PIONEER®

Graham Ham
Products Manager Hi-Fi
Pioneer Electronics Australia Pty. Ltd.

"Pioneer and TDK engineers constantly work to set new standards of tape performance – and TDK delivers the wide frequency response typical of Pioneer decks."



Sansui®

Geoff Brown
Marketing Director
Vanfi (Australia) Pty. Ltd.

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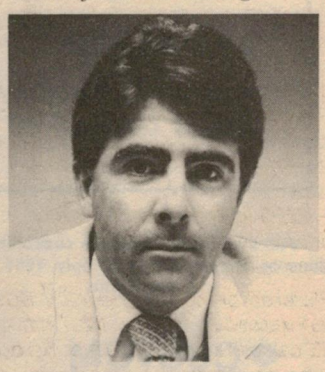

YAMAHA

John R. Fahey
Marketing Manager – Audio
Rose Music Pty. Ltd.

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Note: Any person practising tape recording should observe the provisions of the Copyright Act 1968. TDK 8639

Sharp's new "Video Champ 2300" offers a new look and a new concept in VCRs. In the home it can operate just like any other domestic VCR but standing upright rather than in the usual horizontal position. For use out-of-doors, and away from the AC power mains, it can be carried with the aid of a shoulder strap and used with a camera such as a Sharp's new XC-30. Expected retail price levels are around $1300 for the Video Champ 2300 and around $700 for the camera.

Australia, and Chairman of AAVTA, also points up the sectional nature of the Australian Copyright Council and the fact that members could be seen to have a vested interest in copyright levies. The taping industry is not represented at all.

He goes on:

"One interesting aspect of this is that, according to Schedule III of the Copyright Act, most of the taping done off TV and radio is illegal. So, if the Attorney-General agrees to place a levy on blank tapes to refund so-called lost royalties to the artists, then the Attorney-General is condoning illegal taping.

"How can something on one hand be banned and, on the other hand, taxed?"

The Association also argues that most of the programs shown in Australia are overseas sourced and wonders who will get the royalties — local artists or overseas artists.

Again, according to Paul Wilcock, no specific copyright owner can be nominated when a levy is attached to a blank tape. How does the collection agency propose to distribute the funds so collected?

He concludes:

"With the growth of videography and home music making, a great many tapes are sold for just that purpose — creative home entertainment. Should these people be penalised?"

That attitude of AATVA members is predictable, of course, but it is also quite legitimate — and it is likely to harden in direct proportion to the demands of those who would seek to impose a blanket levy on blank tapes.

Assuming that the AAVTA can make their point successfully to the Government, that should put everybody neatly back to square one — busily doing their own thing!

In brief

NOISE REDUCTION SYSTEMS have provided something of a battleground for Japanese equipment manufacturers in recent times. The Dolby-C system, an extension of the widely used Dolby-B, has been the subject of licence agreements with at least a dozen major Japanese manufacturers including JVC, Hitachi, Sony, Pioneer, Aiwa, Marantz and Nakamichi. However, there is still a lot of push behind other systems like ADRES

From R. H. Cunningham

Shown above is the 104-page 1981-82 catalogue of professional audio products from R. H. Cunningham Pty Ltd, of 146 Roden St, West Melbourne, 3003. It lists and illustrates a wide range of normal and "wireless" Sennheiser microphones and accessories, K&M music stands, Neutrik connectors, Sennheiser headphones and infra red systems, test and metering equipment, conference systems, variable speech controllers, etc. Copies of the catalogue are available free to professional users who apply on Company letterhead. See address above.

National Panasonic highlights in-car audio

Television viewers who watched the National Panasonic Grand Prix at Caulder Motor Raceway on television, during November, would have no idea of the on-site promotion which the company turned on for National's car audio products. On the Saturday, 40 National Panasonic executives and dealers from NSW flew in to join their Victorian counterparts, and guests from Japan, to view and discuss the new product lines — and to take in the Grand Prix on the following day. The equipment was demonstrated in situ in a Porsche, a Commodore and a Statesman, the latter with an RM-710 cockpit unit, which took the eye of guest speaker and racing driver Alan Jones, pictured above.

(Toshiba), High-Com (Telefunken), New NR (Sony), dbx-II (dbx), Super-D (Sanyo) and Compander (Hitachi). Of these, dbx-II would seem to have the brightest prospects, with backing from Matsushita, Yamaha, TEAC and Marantz. Logically, they cannot all remain economically viable and the tip is a final contest between Dolby-C and dbx-II.

AUDIO ENGINEERS PTY LTD have added the SM85 to their range of rugged, professional, studio quality condenser microphones. It is intended to be hand-held and, along with its very high performance charactertistics, is protected against RF penetration and extremes of temperature and humidity. It has a multi-stage pop filter, a wide-range "presence" peak, extended high frequency response, controlled low frequency roll-off and provisions to minimise handling noise. It has provision for phantom power supply and will operate between 11 and 52V DC. Weight is 180g and length 192mm. [Details from Audio Engineers Pty Ltd, 342 Kent St, Sydney, 2000. Phone (02) 29 6731.]

ROSE MUSIC PTY LTD could hardly wish for greater support than they get through their Yamaha Organ Festival. On the last occasion, over 6000 entrants were involved in the initial dealer festivals across Australia. The respective winners then performed in the State Finals prior to going to Sydney for the National Final at the Seymour Centre. The six top juniors (under 16) and the six top seniors had an all-expenses paid trip and the benefit of coaching by Yamaha staff. Compere at the finals was Ross Symonds (Channel 7, Sydney) and guest artist Ray Thornley. Judges were Lois Singer (Yamaha Music Foundation), Dr John Atwell (theatre organist) and Geoff Harvey (Musical Director, Channel 9, Sydney). Junior section winner was Mark Wyer of Townsville, while the major award winner was Debbie Vallely, herself still a teenager.

SWITCHING TYPE POWER SUPPLIES, now common in TV receivers and used in a few hifi amplifiers, seem set to find wider application in a whole range of mains operated equipment in place of the traditional 50/60Hz power transformer systems. Evolving solid state technology has led to much more reliable switching devices — one of the early problems. It is also becoming practical to push the switching frequency towards 80-100kHz, which contributes to the elimination of "hash" or spurious radiation. A major attraction of switching type power supplies is the possibility of running them from a wide range of input voltages, thereby easing the problem of having to produce different models for different markets.

Hifi Review

Sharp VZ-3000Z combination system

Many of our readers must be wondering about the standard of hifi reproduction available from some of the latest feature-laden combination equipment which seems to be intended more for the average consumer than for the hifi enthusiast. So we decided to review the highly innovative Sharp VZ-3000Z combination system which plays both sides of a record in the vertical mode. The result was that we were pleasantly surprised at the high standard of performance.

The complete VZ-3000Z System comprises three units – a main cabinet, measuring 597mm wide x 378mm high x 173mm deep and standing vertically; and two matching loudspeaker cabinets, each measuring 220mm wide x 378mm high x 220mm deep. Each loudspeaker cabinet is of the bass reflex type, and contains one 160mm woofer and one 50mm tweeter. Mass of each complete loudspeaker cabinet is 4.7kg.

Contained in the main cabinet are a record player, AM/FM tuner, cassette tape recorder, selector switches and tone controls, and stereo power amplifier. Mass of this unit is 14.6kg. Not only does the tuner cover the usual AM and FM broadcast bands, but it also covers two shortwave bands – from 2.3 to 7.3MHz, and 7.3 to 22MHz. Thus the VZ-3000Z System is a truly versatile instrument, which could be described as a complete "home audio entertainment centre".

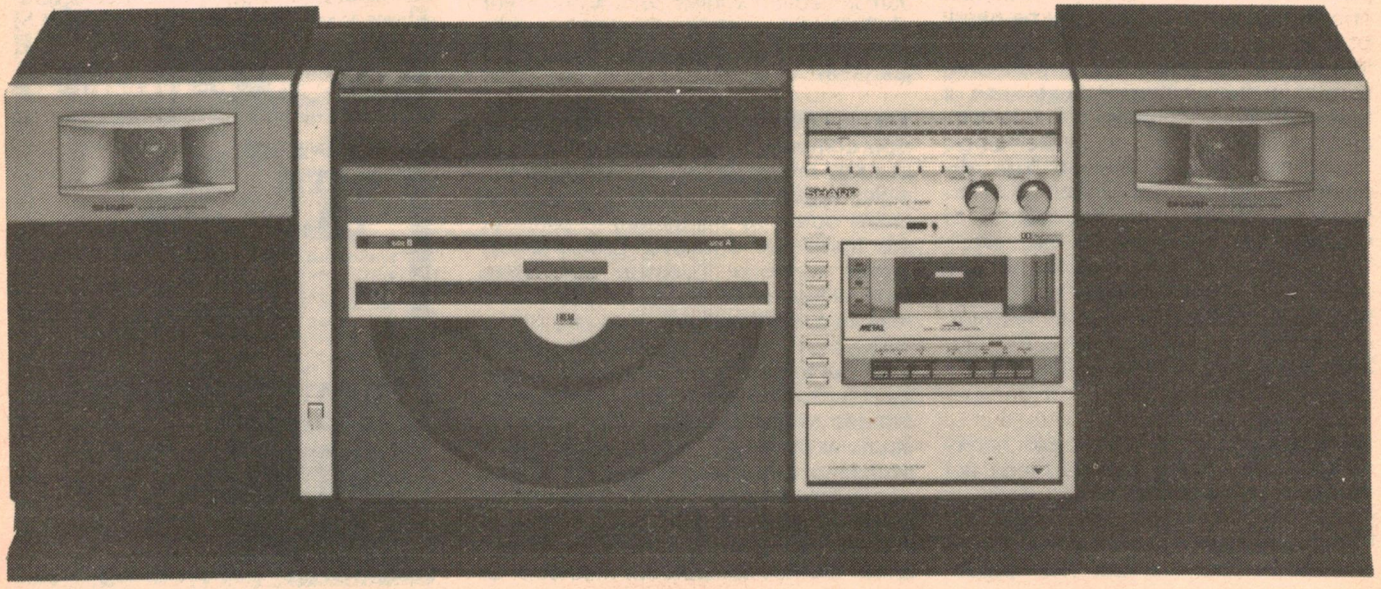
As can be seen from the front view, the record player is located on the left hand side of the front panel, with its row of eight pushbuttons arranged vertically just to the right of its door. Pressing the top button activates a motor which opens the hinged door, taking some seven to eight seconds to perform the operation. The fully open door is inclined at an angle of approximately 45° to the vertical, making it a very simple operation to insert a record, similar to inserting a cassette into a front-loading cassette deck. The VZ-3000Z accepts 18cm and 30cm records and sets spindle speed according to diameter of record.

An internal flap, moulded from a high impact plastic material (as are most constructional parts of the main cabinet), moves slightly outwards as the door opens. The lower half of this flap is contoured into two semi-circles, one to match 18cm, the other 30cm discs. These serve to position the record, such that as the door closes, the tapered spindle enters its centre hole. Mounted on this spindle is a disc, approximately 85mm diameter, which locates the B (reverse) side of the record. A companion disc, positioned in the centre of the lid, meets the spindle as the door is closed. This disc is self-aligning and spring loaded, and as both discs are faced with rubber rings, the record is securely clamped between them.

Being only 85mm diameter, the two discs cover only the label area of a record. Two pickup cartridges – one in the right hand side of the lid; the other in the cabinet itself, just behind the left side of the record – are mounted on linear parallel tracking mechanisms, driven by a single motor. Drive to the "front" mechanism is via a concealed nylon cord (running over low friction pulleys) from the cabinet-mounted motor.

Thus both cartridges move across the record simultaneously; however since individual soleniods control the engagement/retraction of each cartridge, only one side of the record is being played at any one time. This is as it should be, with no additional stylus or record wear being incurred, although stylus pressure would be greater than with top-of-the-line record players. We were unable to measure the exact value, but would guess that it lies between three and five grams.

At this point it should be noted that the previously mentioned "flap" is contoured for minimal contact with the record surface, and is withdrawn prior to the spindle drive motor being started, so that records are not damaged in the



loading process. Similarly, the drive motor is stopped prior to opening of the door for record withdrawal. In addition, the 45° door opening ensures plenty of clearance for the insertion and withdrawal of records with even the clumsiest of fingers.

Styli of the pickup cartridges are quickly detachable, making replacement simple. However, the cartridges themselves are unique to Sharp, making substitution impractical. Sharp state that they are VM type, which is a high impedance magnetic design.

As previously indicated, operation of the record player section is quite simple, being somewhat similar to the operation of a cassette deck. The vertical row of pushbuttons provide the following facilities:

- door open/close. First push opens the door, the second closes the door. Operational time is seven to eight seconds in either direction. The "close" command also initiates start of play, whilst the "open" command both retracts the cartridges and stops the drive motor.
- play/cut. The first press lifts the cartridge and moves it back to its "parked" position. The second recommences play from the "start".
- cue. Similar to a cassette deck's "pause" button, the first press lifts the cartridge from the groove (but maintains its radial position), the second lowers the cartridge back onto the record.
- forward. Push to move the cartridges towards the centre of the record. Play recommences where the button is released (somewhat similar to the "fast forward" function of a tape deck).
- reverse. Push to move the cartridges towards the outside of the record. Play recommences where the button is released (somewhat similar to the "rewind" function of a tape deck).
- both sides play. Depress this button when it is required to automatically play side B after side A (or side A after side B). To indicate this function a curved green line with an arrowhead (located just left of the centre of the lid) is illuminated.
- repeat. Depress for automatic repeat (continuous) play of side A, or side B. Indication of this function is from an illuminated elliptical green line with two arrowheads, located just right of the centre of the lid. If both this button and the "both sides play" button are operated, both sides A and B are repeated, eg ABABA . . .
- side A/side B. Press to change side A play to side B play, and vice versa. Note that illuminated coloured panels are located on the ends of the strip in the centre of the lid; that on the left indicating side B (play) in orange, that on the right side A (play) in green.

From the above it will be seen that these controls provide for virtually all playing needs, with the microprocessor executing the commands in exemplary fashion.

In the lower right hand corner of the VZ-3000Z's front panel is a hinged flap, behind which are located tone and balance controls, record level (for the cassette deck), and microphone volume – for the two supplied microphones. Also located in this area is another pushbutton labelled 33/45, which changes the "turntable" speed. Normally this speed is automatically set according to record size, eg 33⅓ rpm for 30cm, 45 rpm for 18cm. Pressing the 33/45 button will accommodate those records which have been recorded at the converse speed. After use the speed automatically reverts to normal upon removal of the "special" record.

As previously indicated there is no visible turntable (we did not dismantle the cabinet to inspect the coupling between the motor and drive spindle), so we were curious to measure the wow and flutter of the VZ-3000Z. Peak was 0.1% DIN weighted – certainly a better performance than we have obtained from some turntable "separates". Full marks, Sharp.

Setting the tone controls to the nominal "flat" position, and measuring the output across dummy resistive loads (in lieu of the loudspeakers), we found the frequency response to be within ±1.5dB between 60Hz and 12kHz – another commendable performance. Response was −5dB at 30Hz, −4dB at 14kHz and −7dB at 18kHz.

By advancing the treble tone control to provide a little high frequency boost, an even better high frequency performance should be obtained.

Crosstalk was better than 20dB between 100Hz and 5kHz, falling to 15dB at 60Hz and 18dB at 10kHz – a more than adequate result. EMI stereophonic test record TCS-101 was used for both the response and crosstalk tests.

We measured the signal-to-noise ratio below a lateral recorded level of 5cm/sec at 1kHz (which corresponds to the nominal lineup level for 30cm LPs). It varied between 56dB and 62dB depending upon which of the four pickup channels were being checked (remember there are two cartridges, each with two channels). Allowing for the normal 10dB "peak factor", this corresponds to a dynamic range of 66 to 72dB.

The tuner section of the VZ-3000Z is situated in the top right hand area of the front panel, and features an attractive "straight line" dial with an illuminated cursor. Just below the right hand end of the dial are two knobs for volume control (all sources) and station tuning. As one's fingers tend to slip on the tuning knob's smooth surface, and there is no "flywheel" assistance, we felt that a knob with serrated edges would be a worthwhile improvement.

Located in the lower left hand corner of the tuning dial is a five LED bar graph RF signal strength indicator, which is fast becoming standard for FM tuners. Its response, together with the limiting and quieting curves, is shown on the accompanying graph. Note that the 50dB quieting point is attained with 3μV input on mono, and 50μV on stereo. This compares very favourably with results we have obtained from top line tuners. Only in ultimate quieting (where the figures were 66dB mono and 57dB stereo) does the VZ-3000Z lose out to more expensive separate tuners.

No "muting" control is provided, and when tuning between stations in the FM MONO mode, background noise is quite audible. However, in the FM STEREO mode this interstation noise is muted since the RF input signal drops below the "stereo threshold" (ie, unlike most other FM tuners the VZ-3000Z does not revert to mono operation when the signal level drops below the stereo threshold).

19kHz suppression was 46dB down, whilst 38kHz suppression was greater than 60dB. The residual 19kHz is of no practical consequence since the inbuilt cassette recorder incorporates a built-in notch filter which is permanently in circuit.

Frequency response of this tuner was very good, being within ±0.5dB between 20Hz and 12kHz, and only −2dB down at 15kHz. The separation between channels was better than 34dB between 100Hz and 8kHz, changing to 30dB at 50Hz and 10kHz, and 24dB at 15kHZ. We obtained distortion readings of 1% at 100Hz, 0.7% at 1kHz and 1.5% at 6Hz in the mono mode; whilst in stereo the respective readings were 1%, 0.9% and 2.3%.

But while the FM section is of a high standard, the AM section is nothing to get excited about, although it is on a par with most AM/FM tuners. And, as previously mentioned, it does cover two shortwave bands which is a feature. Performance on these two bands appears to be more than adequate for normal shortwave listening.

A row of eight pushbuttons is situated just below the left side of the tuning dial, and is used for input (source) selection. Sources are PHONO, TAPE, AUX, FM STEREO, FM MONO, MW, SW1 and SW2. The auxiliary input is connected to a DIN socket which is located on the rear panel. In normal fashion, "selected output" is taken to this socket (via series 100kΩ resistors).

The cassette recorder section is of conventional front loading design with "soft touch" controls. Mechanical operation is very smooth; in particular the EJECT function produces one of the most satisfactory door opening actions we have encountered, due to optimal damping of the mechanism. Conforming to standard practice for medium-price machines, the VZ-3000Z has the usual combination record/replay head with switchable electronics and Dolby-B noise reduction circuitry.

Control follows normal lines, except that one must remember to depress the TAPE selector button as well as the PLAY

button in order to listen to a cassette. [During testing this reviewer was constantly forgetting to do this when changing from the RECORD mode (via STOP and REWIND) to the PLAY mode.]

Tape speed was spot-on, with peak wow and flutter measuring 0.09% DIN weighted. Fast forward and rewind times were each a little over 100 seconds for a C60 cassette.

At first sight the vertical bar graph level meters, apear to have ten segments but in reality, there are only five segments, as each LED simultaneously appears in two "windows". Calibration points are at −13, −8, −3, 0 (with Dolby symbol) and +3, with accuracy better than ±0.3dB. With such coarse graduations it is difficult to accurately set levels when making live recordings, although one can probably get by when copying professional material, since the levels will have already been adjusted.

A Dolby-B reference level (200nWb/m) cassette played back at the Dolby mark, giving approx 150mV open-circuit output from the DIN socket. However it should be remembered that the internal output impedance at this socket is 100kΩ. Replay frequency response was within 2dB to 6kHz, and 5dB down at 10kHz.

As there is no variable HF bias control, we used cassettes specifically recommended by Sharp for the overall performance tests. They were Maxell UD (IEC type I), Maxell UDXLII (IEC type II) and TDK MA (IEC type IV).

All three cassettes produced essentially the same overall frequency response; within ±2dB between 50Hz and 15kHz, and dropping to −7dB at 30Hz. Above 15kHz the response fell away sharply (approx −18dB at 17kHz) due to the effect of the MPX filter.

Overall distortion figures were essentially the same for all three cassettes. At a recorded level of 160mWb/m at 1kHz, distortion measured 1.2%; and at 6dB above (nominal 320nWb/m) was 5% for types I and IV, and 6% for type II.

Replay of a previously recorded cassette showed distortion of 0.85% at the 160nWb/m level; 2% at +6dB and 3.5% at +8dB indicating that the replay channel is not overloading.

Unweighted signal-to-noise ratio below 200nWb/m was 51dB for the type I, 54dB for the type II and 53dB for the type IV. With Dolby B selected these figures improved to 58dB, 59dB and 59dB respectively.

The net result of these tape performance figures is that the cassette section is easily equivalent to most medium price separate cassette decks.

Unusual for mains operated equipment is the use of 4Ω loudspeaker units. To drive into 4Ω loads the power amplifiers must be designed to handle larger currents, and should therefore be more easily able to cope with 8Ω loads. And such is the case with the VZ-3000Z. At its rated output of 20 watts, the harmonic distortion was less then 0.05% at 1kHz and lower frequencies, and only 0.08% at 10kHz; readings which were essentially the same irrespective of whether it was feeding 4 or 8Ω loads. However as an indication of the VZ-3000Z's ability to deliver high output currents the maximum power output at the onset of clipping, with both channels driven is 23 watts into 8Ω and 30 watts into 4Ω.

Tests for stability indicated no problems whatsoever, ie, the VZ-3000Z can be considered unconditionally stable. Square wave response was also very good, although the rise and fall times were a little longer (approx 10 to 15μs) than on some top-of-the-line amplifiers. However, its response to adding parallel capacitance across the load was perhaps the best we have ever seen. Whilst the wave shape altered as the capacity approached 1.0μF and larger, there was virtually no "ringing" or damped oscillation as is usually encountered.

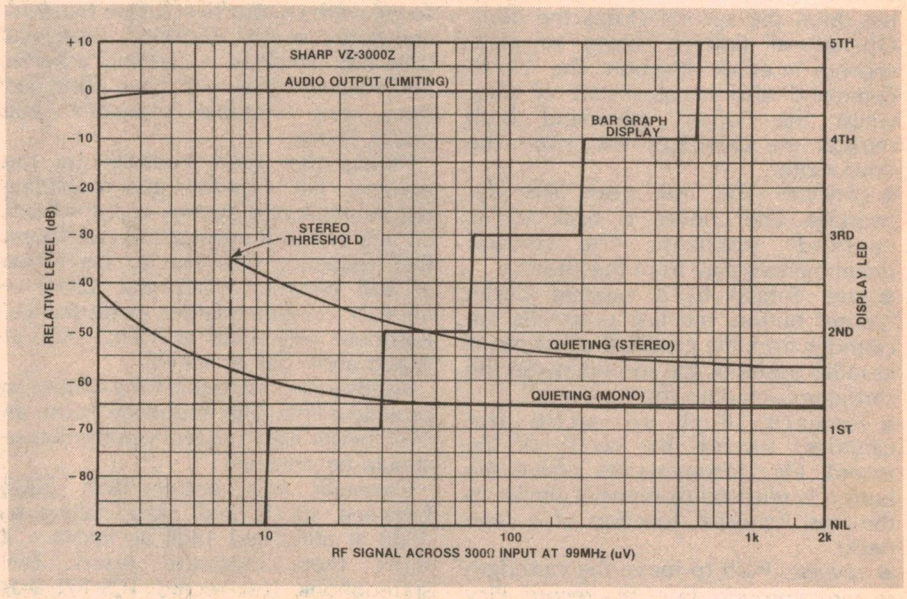
Unweighted signal-to-noise ratio of the power amplifier section was 84dB below 20 watts, corresponding to 71dB below 1 watt – a very good figure.

We took frequency response figures with the tone controls both set to 12 o'clock and found it to be within ±1.5dB between 40Hz and 20kHz. Separation between channels was 52dB at 1kHz, and 35dB at 10kHz.

The treble control produces a symmetrical amount of boost and cut, amounting to some 9dB at 10kHz. A switched loudness facility is included a lifts the response by 3dB at 7kHz, and 5dB at 10kHz. It also provides a lift of 3dB of 250Hz, shelving to 6dB at 50Hz.

While the bass control can attenuate the response by up to 9dB at 100Hz and 15dB at 30Hz, maximum boost is 7dB at 100Hz and only 4dB at 30Hz. This characteristic of limiting the response below 50Hz appears to be a deliberate Sharp design feature (vide the record player and cassette deck low frequency response) with which we concur, particularly since the response of the supplied loudspeakers falls away rapidly below about 80Hz.

Actually the loudspeakers produce quite a pleasant sound although for critical listening the upper bass register is somewhat over prominent, with the lower bass register somewhat lacking. It should be pointed out that it is quite normal for speaker enclosures of 15 litres (or less) to be less efficient in the lower bass region.



From the foregoing it will be seen that this Sharp VZ-3000Z is a most interesting design concept with its "both sides play" vertical record player, AM/FM tuner and cassette deck being combined into the one cabinet. It certainly produces a better than average performance in each of its functions, and provides a satisfying sound from its loudspeakers. Further, if at some later date, an improvement was desired, it would be quite simple to substitute better loudspeakers with the knowledge that the electronics performance is of a high standard.

Recommended retail price of the Sharp VZ3000Z "Both Sides Play Disc Combo System" is $989 including sales tax, although we understand it will normally sell for around $900. Further information and details can be obtained from retailers (note that the VZ-3000Z is not restricted to high fidelity outlets), or the distributors, Sharp Corporation of Australia Pty Ltd, 64-72 Seville St, Fairfield, NSW, 2165. (P. de N.)

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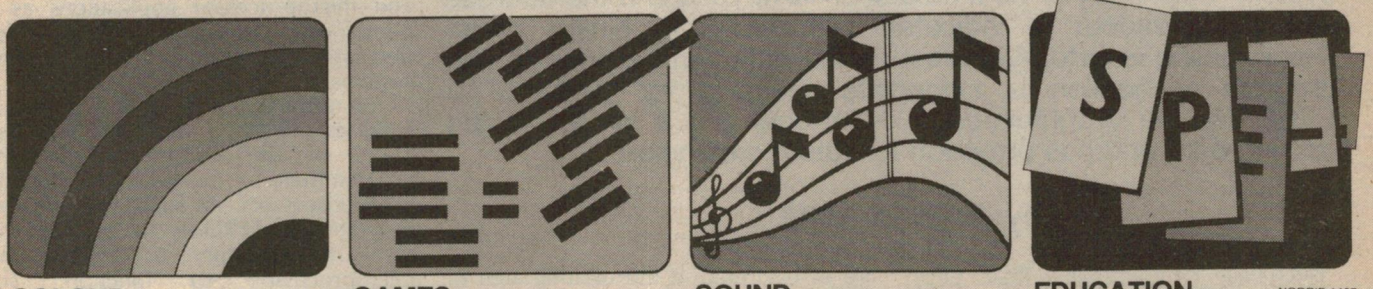

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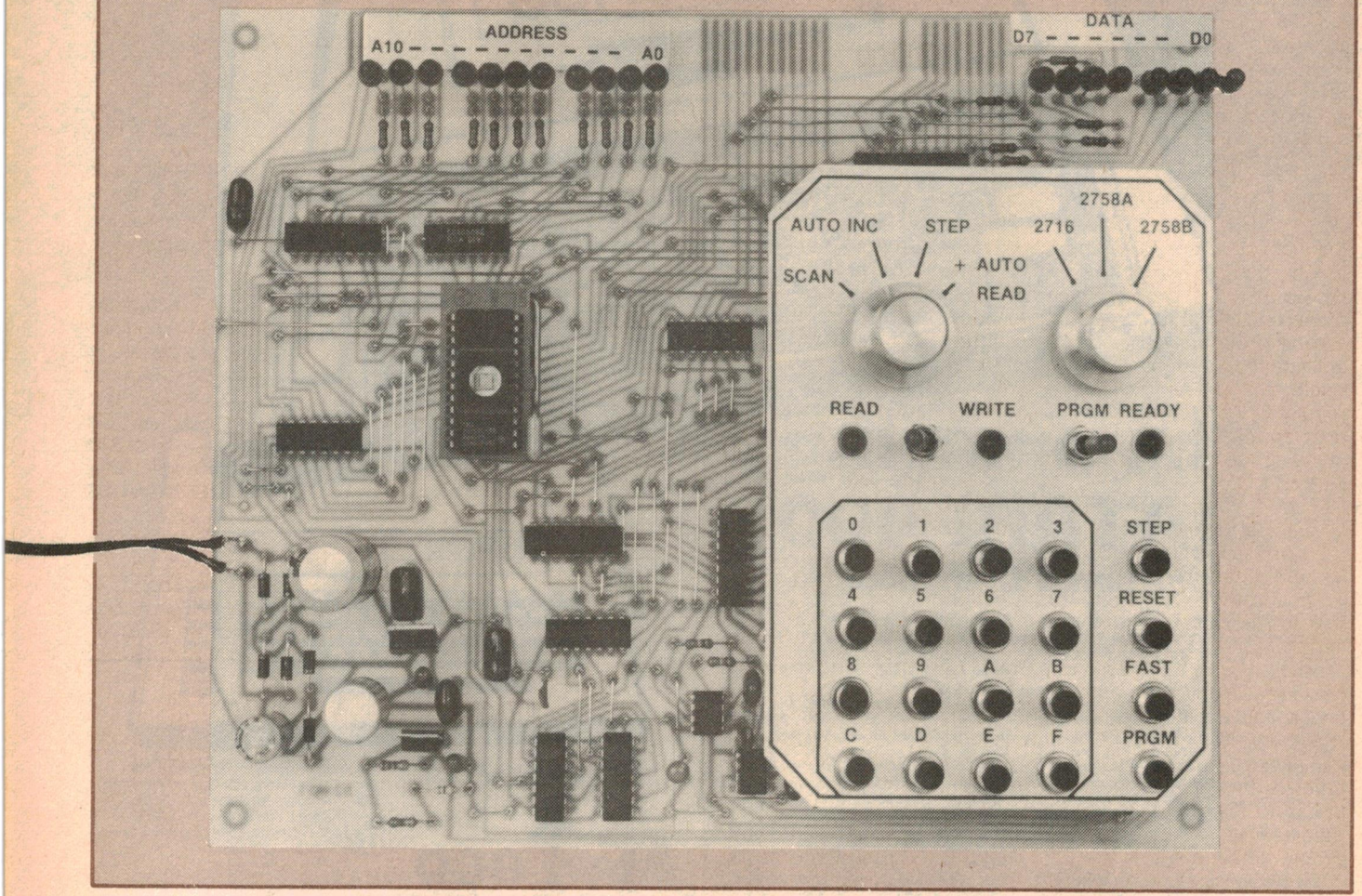
An easy-to-use EPROM Programmer



This simple and inexpensive EPROM programmer operates without the need for a personal computer or microprocessor system. Data entry is via a hexadecimal keypad and the address and data readout is indicated with LEDs in binary code. Programming is virtually as fast as the data can be entered and program verification is immediate. Suitable for 2716/2758 EPROMs, the programmer is construced on a single printed circuit board and has provision for future expansion.

by JOHN CLARKE

Electrically Programmable Read Only Memories (EPROMs) are ideally suited for development work, where the final contents of the ROM may have to be arrived at by trial and error. They have the advantage of being a permanent memory but they can be easily erased and new or revised data added.

Some of the many uses for an EPROM are to be found in the exciting area of dedicated control. Robotics, industrial controllers, train controllers, speech synthesisers, burglar alarms, light shows, display drivers and code converters benefit greatly in terms of versatility when using an EPROM. In fact, complete redesigns can be made simply with modifications to the EPROM program. In most cases no hardware changes are required. Of course, EPROMs are also used widely in small system computers and microprocessor applications as a permanent memory storage for dedicated programs and operating systems.

One of the major problems with using EPROMs has been with programming. Many of the commercial EPROM programmers available contain microprocessors. As such, they require programmed EPROMs to provide the software necessary to enable the microprocessor to function. For constructors, this presents a problem since an EPROM needs to be programmed before the programmer can be completed. A tricky situation to be sure.

An alternative is a programmer designed to be controlled by a personal computer (such as our EPROM

Programmer for the TRS-80, July/August, 1980) but these require special software and not everyone has access to a personal computer.

Up till now, EPROM programmers virtually demanded the assistance from a computer or microprocessor to perform the repetitive cycling required of the popular but now outdated 2708 EPROM. In fact, for this EPROM it is necessary to apply a short programming pulse between 0.1 and 1ms long to each memory location in sequence. Once all the memory addresses have been accessed and each pulse applied, this entire sequence has to be repeated again for many loops. The minimum number of loops required is 100 when the pulse width is 1ms, and 1000 loops with a 0.1ms pulse width.

Obviously this procedure would be very tedious if it were attempted manually, perhaps taking many days.

With the advent of the newer 2716 type of EPROM, programming has been made considerably easier. Any location can be programmed at any time either individually, sequentially or randomly. A single TTL 50ms pulse is all that is required to perform the complete programming of each location. It is not necessary to repeat the process as in the 2708 EPROM.

In short, to program the 2716 EPROM all that is required is to apply 25 volts to the Vpp pin of the IC, select the address, set up the data required, apply the 50ms pulse and the EPROM is programmed in that location. Programming manually is almost as fast as the data can be entered.

Obviously, with the ease that the 2716 EPROMs can be programmed, a simple circuit can be made to program them. We wanted to produce a simple and inexpensive programmer which requires no assistance from a personal computer, nor from a preprogrammed EPROM. In particular we wanted it to be capable of programming not only the 2716, but the 2758 EPROMs as well.

The 2758 is a 1K version of the 2716, a 2K EPROM, but with one half of the memory defective. Rather than throw these devices away, manufacturers label them 2758A or 2758B depending on which half of the die is defective. These have an advantage over the 2708 in that they have the easier programming method and are a single supply EPROM (the 2708 needs −5, +5 and +12 volts) like the 2716.

The unit is easy to construct, inexpensive and yet does not lack in features. It can read the contents of the EPROM to check that it has been erased before programming and check that the EPROM does in fact contain the correct data after programming. As well, there is a special fast scan which enables a certain address to be accessed quickly.

Extra features include automatic increment of the address when programming and an automatic check of the EPROM contents directly after programming each location.

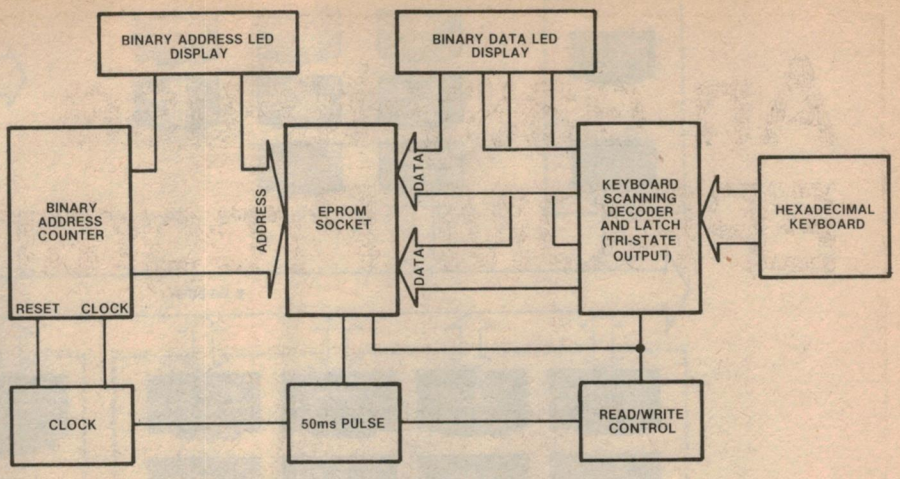


FIG. 1

Fig. 1: block diagram for the new EPROM Programmer. Data is entered via a keyboard and decoded to 8-bit binary data with the keyboard scanning decoder.

Although programming a single location can be achieved independently of other memory locations, erasure (with UV light) of the data affects the entire memory contents. If the data at one address was to be altered, the complete memory contents would need to be erased and re-entered with the revised data. The exception to this is when all the data required to be changed is from a "1" to a "0", in which case the 1 can be reprogrammed to 0.

In fact, this explains the concept of the EPROM: erasing brings all the bits high, "1", and programming can only send the bits low, "0".

HEXADECIMAL AND BINARY CODES

Many readers who have seen programming lists for EPROMs will have noticed that the address and data are generally shown in hexadecimal. The hexadecimal number is really just an easier and shorter means for expressing a 4-bit binary number which has 16 possible codes. Since our programmer only displays the address and data in binary, the code will have to be converted. Fig. 2 shows the conversion table for the hex and binary codes.

The LED readouts are arranged in blocks of four. This helps with decoding since each block is read as a hexa-

PARTS LIST

1 PCB, 230 × 188mm, coded 82ep1
1 Scotchcal label, 117 × 140mm
2 knobs
1 sheet of aluminium, 117 x 140mm
6 rubber feet
1 24-pin IC socket
20 pushbutton switches
1 SPDT switch
1 DPDT switch
1 double-pole, three position rotary switch
1 double-pole, four position rotary switch

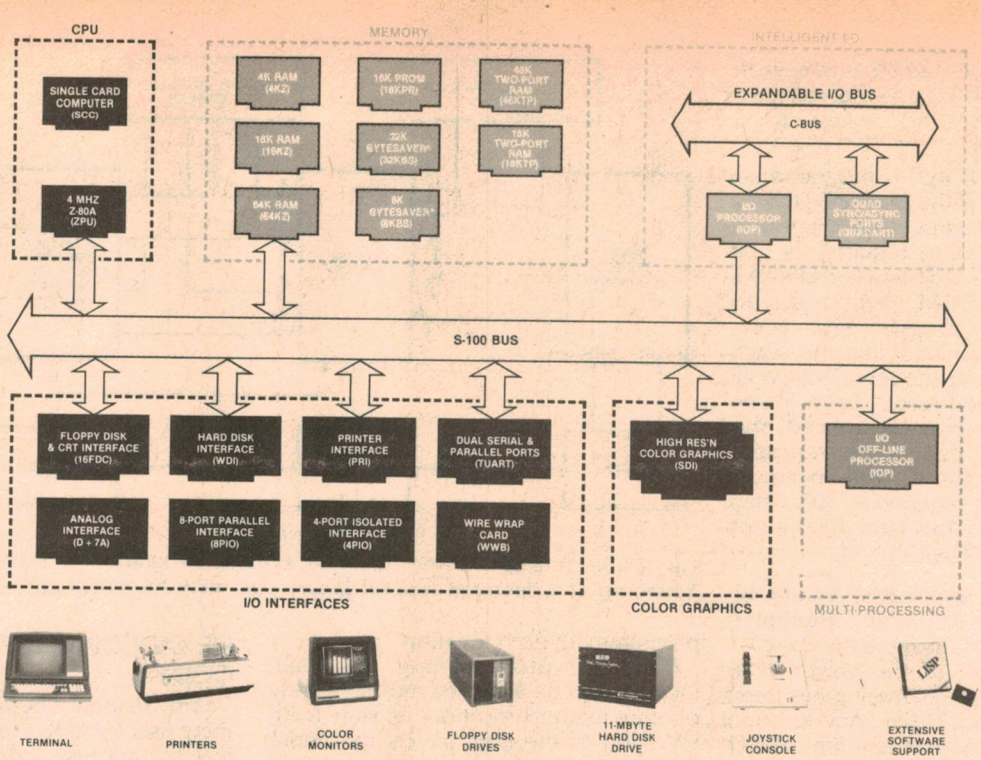
SEMICONDUCTORS
1 74C922 16-key encoder
1 4040 12-stage ripple-carry binary counter
1 4503 hex non-inverting Tri-state buffer
2 4050 hex non-inverting buffers
1 74LS173 Tri-state quad D register
1 74LS74 dual D flipflop
1 74LS14 hex Schmitt trigger
1 74LS04 hex inverter
1 74LS00 quad NAND gate
1 81LS95 Tri-state octal buffer
2 555 timers
1 7805 5-volt 1A regulator
1 LM317T adjustable three-terminal regulator
6 1N4002 1A silicon diodes
22 5mm diameter red LEDs

CAPACITORS
1 1000µF/25VW electrolytic
1 220µF/35VW electrolytic
1 220µF/25VW electrolytic
1 10µF/35VW electrolytic
3 10µF/16VW electrolytic
1 2.2µF 16VW electrolytic
5 0.1µF metallised polyester
2 0.047µF metallised polyester
3 0.01µF metallised polyester
1 100pF ceramic

RESISTORS (¼W, 5%)
2 × 1MΩ, 3 × 100kΩ, 1 × 3.9kΩ, 3 × 2.2kΩ, 23 × 1kΩ, 1 × 330Ω, 1 × 220Ω

MISCELLANEOUS
Tinned copper wire, solder, etc.

Note: Components specified are those used in the prototype. In general components with higher ratings may be used provided they are physically compatible.



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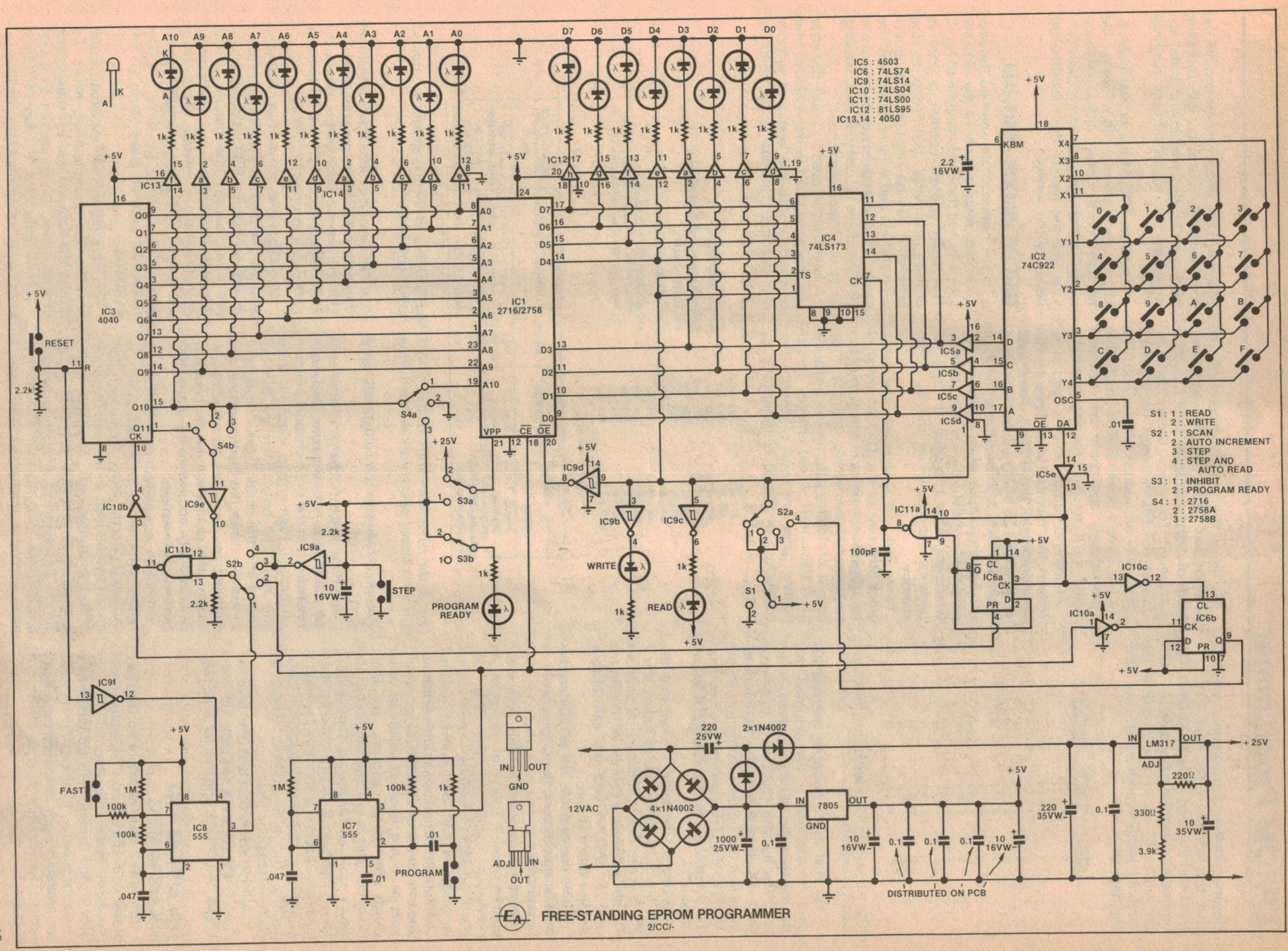
IC5 : 4503
IC6 : 74LS74
IC9 : 74LS14
IC10 : 74LS04
IC11 : 74LS00
IC12 : 81LS95
IC13,14 : 4050
IC1 2716/2758
IC2 74C922
IC3 4040
IC4 74LS173
IC7 555
IC8 555
IC9a
IC9b
IC9c
IC9d
IC9e
IC9f
IC10a
IC10b
IC10c
IC11a
IC11b
IC5a
IC5b
IC5c
IC5d
IC5e
IC6a
IC6b
7805
LM317
RESET
STEP
PROGRAM READY
WRITE
READ
PROGRAM
FAST
S1 : 1 : READ
2 : WRITE
S2 : 1 : SCAN
2 : AUTO INCREMENT
3 : STEP
4 : STEP AND AUTO READ
S3 : 1 : INHIBIT
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decimal number. For example, suppose that the address LEDs read 101 1111 0101 and the data LEDs, 0011 0000. The equivalent hexadecimal would be, using the table, 5F5 30. In other words in the memory location address 5F5, we have the data 30.

HEX NUMBER	4-BIT BINARY WORD	EQUIVALENT DECIMAL
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
A	1010	10
B	1011	11
C	1100	12
D	1101	13
E	1110	14
F	1111	15

Fig. 2: conversion table for hex and binary numbers.

Note that, in the example, we read 101 as a hexadecimal 5. We assumed that the most significant bit was a zero. In fact we have left this LED out of the circuit since it is unnecessary. The maximum address that can be counted up to with the 2K EPROM is 2047 decimal. If we convert this decimal number to hexadecimal, we obtain 7FF.

Looking to the table we see that the hex numbers up to and including the 7 all have the most significant bit as 0. So we do not have a change in this bit for our 2K EPROM and we can always assume that it is zero.

With some practice, these LEDs can be read as quickly as if the display were in hexadecimal.

Before we proceed further, let's clear up one possible source of confusion. As previously mentioned, the 2716 has 2048 possible locations, or in digital language 2K. In the normal decimal counting system, if we counted the address locations of the EPROM we would start at 1 and finish at 2048. In other words the final address is 2048. However, this is not the method in the binary system. We always start from 0. This is because a binary counter starts counting at 0 and a memory location is available at this zero location. Consequently, the final address when we count in binary is 2047.

It follows from this that the final address is 7FF for a 2K EPROM, 3FF for a 2758A 1K EPROM, and 7FF for a 2758B.

THE EPROM AND PROGRAMMING

Let's take a look at the basic structure of the 2716 EPROM to understand these processes more fully. Internally it contains 16,384 storage cells (or bits) which can store either a "1" or a "0". These cells are arranged eight bits wide (one byte) and so functionally it is a 2048 × 8 EPROM.

As far as the user is concerned, the EPROM has 2048 effective addresses, each of which can store eight bits of information. To select these 2048 addresses the EPROM must be provided with an 11-bit address, A0 to A10. The 11 bits have a possible 2048 truth table combinations and these are decoded within the IC to select the required byte.

An internal output buffer is used to interface the memory data lines to the data outputs of the EPROM. These data outputs can be switched from an input when the data is to be programmed, or used as the output when in the normal read mode. A third state is also available which provides a floating or high impedance output, when the IC is on standby.

Now that we understand the basic block structure of the EPROM we shall venture into the physical structure of the storage cells themselves. Basically, they consist of floating-gate avalanche-mode MOS transistors. Stored charges on the floating gates are used to control the conduction of the MOS transistors, to determine whether they effectively store a "1" or a "0".

The floating gate's charge is produced by inducing a non-damaging avalanche breakdown in the drain-channel junction of the cell. High energy electrons from the avalanche breakdown are then injected into the floating gate, charging it negatively. Since the floating gate is surrounded by an extremely effective insulator, this charge will remain practically indefinitely, and hence the stored pattern will also remain.

To erase a programmed EPROM, a quartz window is provided which is mounted directly above the IC such that an ultra-violet light source can be shone onto the storage cells. The light at the particular wavelength of 2537 Angstroms has sufficient energy to release the trapped electrons from the floating gate, leaving it uncharged. The erased memory cells effectively all contain 1s. Programming consists of inducing avalanche mode breakdowns in the appropriate cells to provide the required zeros.

A suitable EPROM eraser was published in our February 1979 issue, file number 2/cc/36. Copies of this article are available through our Information Service. See the rear of the magazine for details of this service.

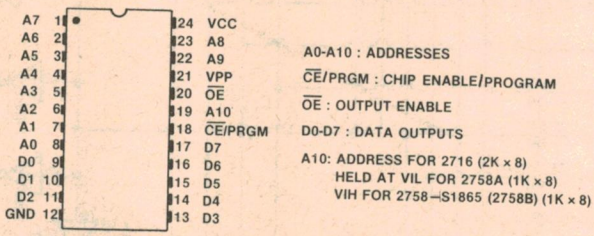
CIRCUIT BLOCK DIAGRAM

To see how we have satisfied the programming requirements of the EPROM, take a look at the block diagram of Fig. 1. The binary address counter is used to provide sequential addressing to the EPROM. It can be reset to start at the zero address and is incremented by the clock. This allows us to access any of the 2048 locations by resetting and counting up to the required address.

A keyboard is used to enter the data and this is decoded to the required 8-bit binary data with the keyboard scanner and decoder. Latching is provided so that the data just entered will remain on the data bus. When programming the EPROM, the decoder output drives the EPROM data lines which are set to be inputs (write or program mode).

When data is to be read out from the EPROM, the data lines are outputs (read mode). So that the EPROM data lines do not have to drive the outputs of the decoder when in the read mode, these outputs are set to Tri-state. The Tri-state refers to a floating output which requires very little current to drive it. The read/write control takes care of this switching.

The 50ms pulse is self explanatory and provides the programming pulse. To display the data and address states, each of these lines is connected to a LED which will indicate a "1" when the LED is lit and a "0" when the LED is unlit.



PINS / MODE	CE/PRGM (18)	OE (20)	VPP (21)	VCC (24)	DATA OUTPUTS (9-11) (13-17) D0-D7
READ	VIL	VIL	+5V	+5V	DATA OUT
STANDBY	VIH	VIL OR VIH	+5V	+5V	HIGH IMPEDANCE
PROGRAM	PULSED VIL TO VIH	VIH	+25V ±1V	+5V	DATA IN
PROGRAM VERIFY	VIL	VIL	+25V ±1V	+5V	DATA OUT
PROGRAM INHIBIT	VIL	VIH	+25V ±1V	+5V	HIGH IMPEDANCE

Fig. 3: the pin connections for the 2716/2758 EPROMs and the voltage levels required on the control pins to obtain the various operation modes.

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THE CIRCUIT

Fig. 3 shows the pin connections for the 2716/2758 EPROMs and the various voltage levels required on the control pins to obtain the operation modes. In our programmer, we have used all modes of the EPROM with the exception of the standby mode. To see how we have met the specifications for programming, program verify and read, we shall now discuss the circuit.

Heart of the circuit is IC1, the EPROM, or more correctly the EPROM socket. Most of the address lines are directly connected to the 4040, IC3, a 12-bit binary counter. The exception is A10 which is connected to Q10 of the counter only when switch S4a is in position 1. This position is suitable for the 2716 EPROM. The other two positions of the switch connect A10 to either the positive or ground rail, to provide for both versions of the 2758 EPROM.

IC3 is controlled by two inputs, the reset and clock. Resetting is effected with the reset switch by pulling pin 11 high. This brings all the outputs of the counter low. The reset is normally held low with the 2.2kΩ resistor to prevent false resetting. The clock input is gated with IC11b, a NAND gate, and inverted with IC10b. The reason for this inversion shall become clear later. Clock signals, selected with S2b, are sent to pin 13 of IC11b. This signal can pass to the output of IC11b only when pin 12 is high.

The pin 12 input of IC11b is normally held high with the inverter IC9e. The input to IC9e, pin 11, is normally held low with Q11 (pin 1) of IC3, when S4b is in position 1. When the switch is in positions 2 and 3, Q10 connects to IC9e. When IC3 finishes the count of 3FF hex or 1023 decimal, Q10 goes high and indicates the end of memory for the 2758A EPROM. The inverter, IC9e, will go low preventing any further clock pulses to IC3. The address outputs will now remain in this state, all other outputs low and Q10 high until the counter is reset.

Similarly, when S4b is in position 1, the clock will be stopped when Q11 goes high at the finish of the 2047th count or 7FF hex.

Data entry to the EPROM is a little more complex. A 4 × 4 matrix keypad is used to enter data and IC2 is used to scan and encode the keypad. The capacitor connected at the oscillator input, pin 5 of IC2, sets the rate at which the keypad is scanned. When a key is pressed, IC2 determines which contacts are closed and presents the 4-bit binary code at the data outputs, pins 14 to 17.

This data is buffered with the Tri-state buffers, IC5a to IC5d. After a key debounce period, set by the capacitor connected to KBM, pin 6, the Data Available output, DA, pin 12 (buffered by IC5e), goes high.

IC6a, a D flipflop, is connected to divide by two and is clocked by the output of IC5e. At each positive-going clock signal the $\overline{Q}$ output changes state from a low to a high or from a high to a low. Assuming that initially $\overline{Q}$ is clocked high when DA goes high, this holds pin 9 of IC11a high. Since IC5e, pin 13, is also connected to IC11a, pin 10, both inputs will be high and the output of IC11a will go low.

As soon as the pressed key of the keyboard is released, the DA goes low and the output, pin 8, of IC11a goes high, clocking the latch, IC4. The input to the latch is transferred to the output when the clock goes high and so the data entered on the keyboard is transferred to the output of the latch and remains there until reclocked.

Upon pressing a key on the keypad again, the DA goes high, clocks $\overline{Q}$ low and this low prevents the output of IC11a from going low for the second time. Subsequently the data just entered remains at the outputs of IC5a to IC5d. The 100pF capacitor at the output of IC11a prevents any glitches causing false latching in IC4.

Now we have the 8-bit data word at the data lines of IC1. The first time the keypad is pressed, the most significant 4-bit word is set, D7 to D4, and the second time the keypad is pressed the least significant 4-bit word is loaded to the data bus, D3 to D0.

IC12 is an octal Tri-state buffer which is used to buffer each of the data lines. The outputs of these buffers drive the data LEDs via 1kΩ resistors. Similarly, the address LEDs are driven by hex buffers IC13 and 14, connected to the address lines.

So far we have discussed the address and data inputs to IC1 and the readout LEDs. This constitutes the major section of the circuitry. The remainder of the circuit consists of the various clocking options available, the programming controls and the power supply.

We shall now describe the clocking modes available by selecting one of the four positions on switch S2b.

Position 1 on S2b allows the astable clock (IC8) to provide a scan through all the memory addresses. The frequency of this clock is around 26Hz and so about 82 seconds are needed to count through all the memory addresses of a 2K EPROM. A fast control, which connects a 100kΩ resistor across the 1MΩ resistor tied from pin 7 to the positive rail, increases the clock rate by about five times and considerably shortens the time to scan the memory locations. When all the memory locations have been accessed, the scanning will stop.

The reset, pin 4 of IC8 (a 555 timer), is connected via IC9f to the reset switch of IC3. Resetting IC8 when IC3 is reset ensures that a full clock cycle is provided for the first memory location before the next memory location is accessed.

Digressing for a moment, we need to discuss the other parts of the circuit before returning to the clocking modes.

IC9b and IC9c are used to drive the write and read LEDs respectively via 1kΩ current limiting resistors. The inputs to these inverters are both connected to the Tri-state controls of IC4 and IC5. Another inverter, IC9d, also has its input connected to the Tri-state line and the inverted output is connected to $\overline{OE}$ of IC1.

When the Tri-state line is high, the read LED is lit, IC1 is in the read mode and the data lines of IC4 and IC5 are in Tri-state. When the Tri-state line is low, the write LED is lit and IC1 is in the program mode. The outputs of IC4 and IC5 are then in the normal output mode.

The Tri-state line is controlled with S2a. When the switch is in positions 1 to 3, S1 determines whether this line is high or low by switching the line to +5 volts or to ground. When S2a is in position 4, the control is effected by the Q output of IC6b. Now let us explain how the programming pulse and the step waveforms are produced.

S3a is used to provide either 5 volts or 25 volts to the Vpp input of IC1. S3b drives the PRGM Ready LED when the voltage at Vpp is 25 volts.

IC7 is used to provide the 50ms programming pulse. Initially, the 0.01μF capacitor connected to pin 2 of the 555 is charged positive on both sides. The 1KΩ and 100kΩ resistors hold both sides of the capacitor high. When the PRGM switch is closed, the 1kΩ side of the capacitor is brought to ground.

Now both sides of the capacitor are effectively at ground potential and pin 2 is brought low, triggering the 555. The capacitor begins to charge through the 100kΩ resistor and the low at pin 2 is gradually brought high. When the PRGM switch is released, the capacitor is discharged.

When the 555 is triggered, the output, pin 3, goes high for the time period of 1.1 × 1MΩ × 0.047μF. The programming pulse is therefore about 52ms, which is well within the range of 45 to 55ms (50± 5ms) necessary for correct programming of the EPROM.

The Step switch is used to provide a clock signal. IC9a is a Schmitt trigger and

We estimate that the current cost of components for this project is

$40

This includes sales tax but does not include the plugpack, ZIF socket, or EPROM.

the input, pin 1, is held high with the 2.2kΩ resistor. Closing of the Step switch immediately brings pin 1 low and the output of the Schmitt goes high. The 10μF capacitor provides debouncing for the switch.

A Schmitt trigger is used to ensure a clean square output waveform in spite of the slow rising of the capacitor voltage when the switch is released.

Refer now to the waveforms of Fig. 4. When S2b is in position 3, the address is incremented at each closing of the Step switch. The falling edge of the clock (Step) clocks the address counter. The program pulse will program the EPROM providing the $\overline{OE}$ is high (write) and Vpp is at 25 volts.

Comparing these waveforms to the table of Fig. 3 shows that the programming conditions are satisfied. When the $\overline{OE}$ is low the programming can be verified and when Vpp is at 5 volts we are in the normal read mode.

The Step + Auto Read mode is a little more complicated and occurs with S2 in position 4. S2b still allows control of the address counter with the Step switch and this is seen as the first waveform under the Step + Auto Read heading of Fig. 4. S2a connects the Q output of IC6b to the Tri-state line.

Initially, the Q output is low and so $\overline{OE}$ of IC1 is high. After the programming pulse, the falling edge (a rising edge after the inverter IC10a) clocks the data at D (+5 volts) to the Q output. The $\overline{OE}$ goes low and we are now in the read mode, reading the just programmed data. When the keypad is pressed, to enter the data for the next location, the DA output of IC2 clears the Q output of IC6b and we are in the write mode again.

Clearly, this mode is quite useful. The just programmed data can be immediately verified before the next location is programmed.

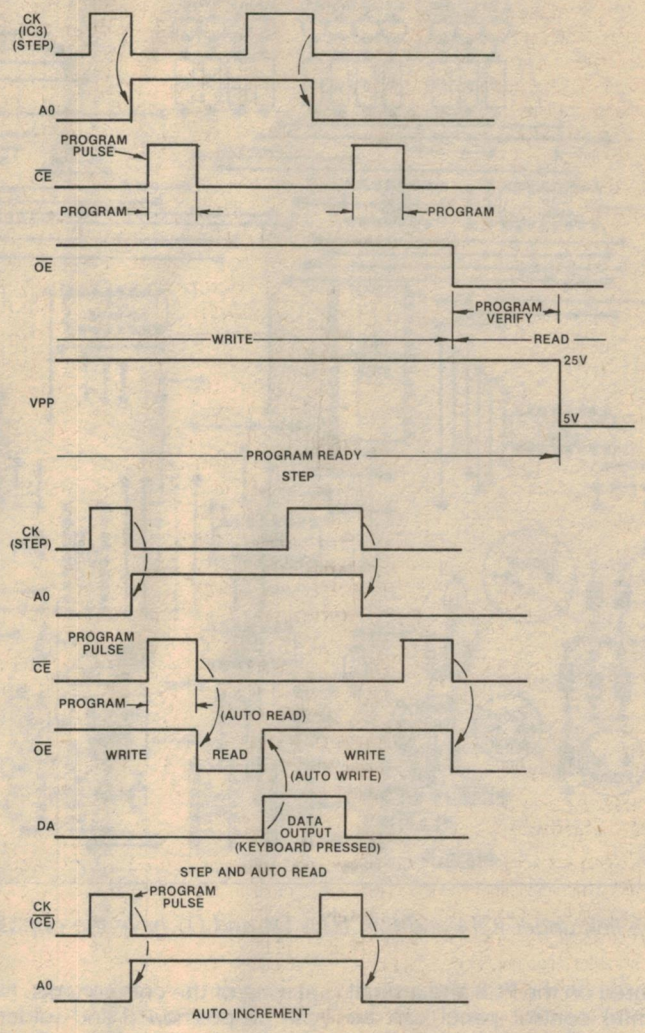


Fig. 4: this diagram shows the waveforms for the various programming modes.

Position 2 of S2b connects the output of IC7, pin 3, to control the clocking of the binary counter, IC3. This is shown in Fig. 4 under the heading of Auto Inc. On the negative edge of the programming pulse directly after programming, the address is advanced by one memory location. To ensure that this is so, we have included the inverter IC10b. In this mode the data can be entered, the programming pulse applied, and the data for the next location entered without regard for incrementing the address, as this is done automatically.

One final point. The output of IC11b is directly connected to the preset pin, pin 4, of IC6a. In doing this, it is ensured that after each clocking of the address, IC4 is ready to latch the first data entered on the keyboard.

This at first may appear unnecessary, since IC4 will latch at every second entry of 4-bit data. However, say we want to enter data which has both items of 4-bit data the same. For example, if we want to enter FF, the first depression of the keyboard, will enter FF. Remember that the first data entry always enters the same data for both 4 bits. The second depression enters the least significant 4-bit data.

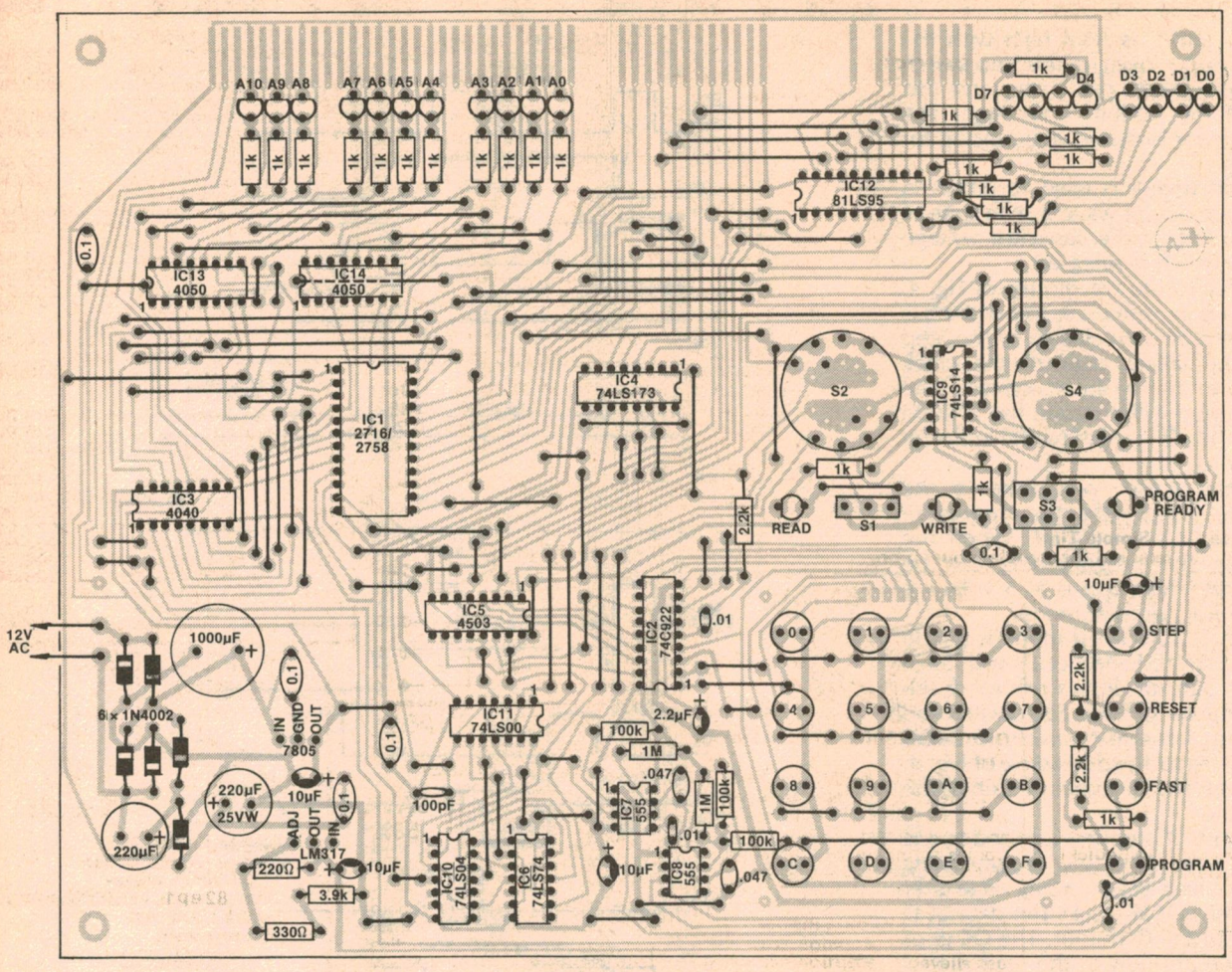
However, what if you, the operator, only pressed the keypad once to enter FF? The program switch would be pressed and the next data entered. At the change in address, the latch is ready to latch the first data. If we did not have this feature, at the next address change the whole data entering would be out of sequence.

Power for the circuit is derived from a 12 volt AC, 500mA plugpack which feeds a full-wave bridge rectifier, and a 1000μF filter capacitor. A three-terminal regulator regulates the voltage to five volts. The 0.1μF capacitor at the input and the 10μF capacitor at the output provide stability and ripple rejection respectively. The remainder of the capacitors connected to the output of this regulator provide decoupling of the supply around the circuit.

A voltage doubler is used to provide about 30 volts at the input to the LM317 adjustable three-terminal regulator. The 3.9kΩ and 330Ω resistors in series to the ADJ terminal and the 220Ω resistor from this terminal to the output provide a well-regulated supply of 25 volts. The 10μF capacitor at the output of the regulator improves the transient response of the regulator.

CONSTRUCTION

All the circuitry for the EPROM programmer is accommodated on a single-sided printed circuit board (PCB), measuring 230 × 188mm and coded 82ep1. All the switches and LEDs are



Note the wire link under IC14 and that LEDs D4 and D5 have the opposite orientation to D6 and D7.

directly mounted on the PCB and a small (140 × 100mm) control panel can be made to fit over the switches. A Scotchcal front panel label has been produced and the overall arrangement of the PCB and label can be seen in the photograph.

The PCB is designed to accept the Digitran keypad as well as separate pushbutton switches for data entry. The keypad will fit directly on to the PCB if the four corner pads are drilled and the eight pins from the keypad fitted into the matching pads on the PCB. Separate pushbuttons are used for the Step, Reset, Fast and PRGM controls. We used a Zero Insertion Force (ZIF) socket for the EPROM, although an ordinary 24-pin socket could also be used.

Note that a pad is left spare on the central left hand side of the PCB and a change of linking in this area can be used for an expansion board which may be published at a later date. The bus brought out on the top of the PCB is also for future expansion.

Start construction by mounting all the links, diodes and resistors. Be sure that the diodes are oriented correctly. Use the overlay diagram to help you in the placing of the components. Next the ICs can be positioned and soldered. Solder the supply pins of the CMOS ICs first with the barrel of the soldering iron earthed and connected to the negative rail of the PCB. Solder the pins quickly to prevent heat from damaging the IC.

CMOS ICs can be recognised by their 4000 or 74C00 series type numbers.

The capacitors and three terminal regulators can now be mounted as well as the LEDs. Try to keep the address and data LEDs all at the same height, as they look better that way. Be careful when soldering the data LEDs since two of them are oriented differently to the others. Note that the electrolytic capacitors must be inserted the correct way around as they are polarised components.

The switches can now be mounted on the PCB. We found it easier to only solder one of the legs of the pushbutton switches first, keeping the lug of the switch almost flush with the base of the PCB. The second lug of the switch can be soldered after the small front panel is fitted.

The rotary switches will need the eyelets cut off the lugs as well as all the unused lugs completely removed (by cutting with side cutters). Before cutting the lugs check the switch operation to make sure that you remove the correct lugs. Use a multimeter on one of the "ohms" ranges and go through each switch movement. When soldering each switch, have the body flush with the PCB. Note that several holes are available for the centre wiper lugs of each switch. This should allow all types of rotary switch to be fitted.

Finally the Read/Write and PRGM switches can be mounted, flush to the PCB. The LEDs for the indications on the front panel are best soldered low on the PCB on one leg only, but do not cut the leads yet.

Fashion the front panel from a piece of sheet aluminium and apply the Scotchcal label to it. Spray the label with a hard setting lacquer to protect the label from being scratched. Drill holes for the switches and LEDs. If the Digitran keypad is to be used, this can be positioned on the front panel so as to cover the locations of the 16 switches. A slot will need to be made for the eight pins for the keypad and stiff wires brought to the PCB.

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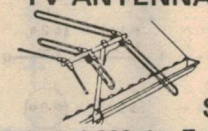

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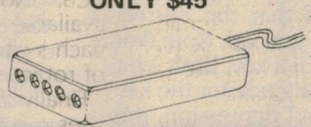

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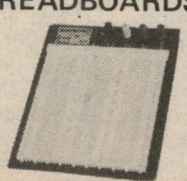

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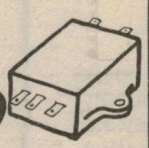

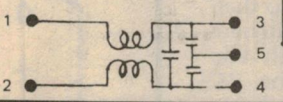

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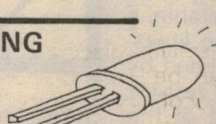

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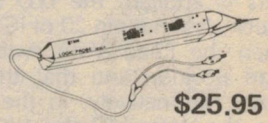

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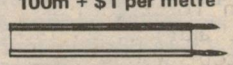

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and tighten up the switch nuts on the panel. The LEDs can be lined up with the front panel by melting the solder of the soldered leg and positioning the LED. The remainder of soldering can now be completed. Solder the unsoldered lugs of the switches first and then reheat the other lugs to remove any mechanical stress that may have been introduced when the front panel was positioned.

Rubber feet should be placed on the corners of the PCB to support it and protect the surface on which it is used.

The A10 to A0 and D7 to D0 Scotchcal labels can be applied to the PCB above the LEDs and the construction is complete. Connect the 12-volt plugpack to the PCB and the unit is now ready to be tested.

TESTING AND OPERATION

Without the EPROM inserted, apply power. Check the voltages at the supply pins of all the ICs, to ensure that they are at ground and +5 volts. Check also that pin 21 of the IC1 socket can be switched from +5 volts to +25 volts with the "PRGM Ready" switch. When the 25 volts is applied, the LED should light. Check also that pin 20 of IC1 is at 0 volts when the Read/Write switch is in the Read position and that the Read LED lights. Alternatively, in the Write position, the Write LED should light and pin 20 should be at +5 volts.

The 5-volt regulator will run quite hot in normal use. However, the temperature at which it runs is well within the specifications of the device.

The +25 volt supply should be between 24 and 26 volts. Anything other than within this range is unacceptable. If the voltage is just outside these limits, then the voltage should be trimmed by adjusting the value of the 330Ω resistor connected to the ADJ terminal of the LM317. Increasing this value will increase the voltage and decreasing the value will decrease the voltage.

Now the operation of the remainder of the controls can be checked. Turn the switch to Scan and the address LEDs will increment: A0 will flash at the highest frequency, A1 will be half this frequency and so on. Pressing the Fast switch will increase the Scan rate.

The counting can be reset with the Reset switch and the counter will stop at 7FF if the EPROM select switch is in the 2716 and 2758B position and 3FF when in the 2758A position. In the case of the 2758B position, the A10 LED will always be lit.

When the addresses are being scanned it is possible to observe the data LEDs, with the Read/Write switch in the Read position. It is easy in this Scan mode to see if the EPROM is erased since all the data LEDs should be permanently lit. For a more detailed examination of the address data in each address, turn the Mode switch to Step. The counter can be Reset and the addresses incremented one by one.

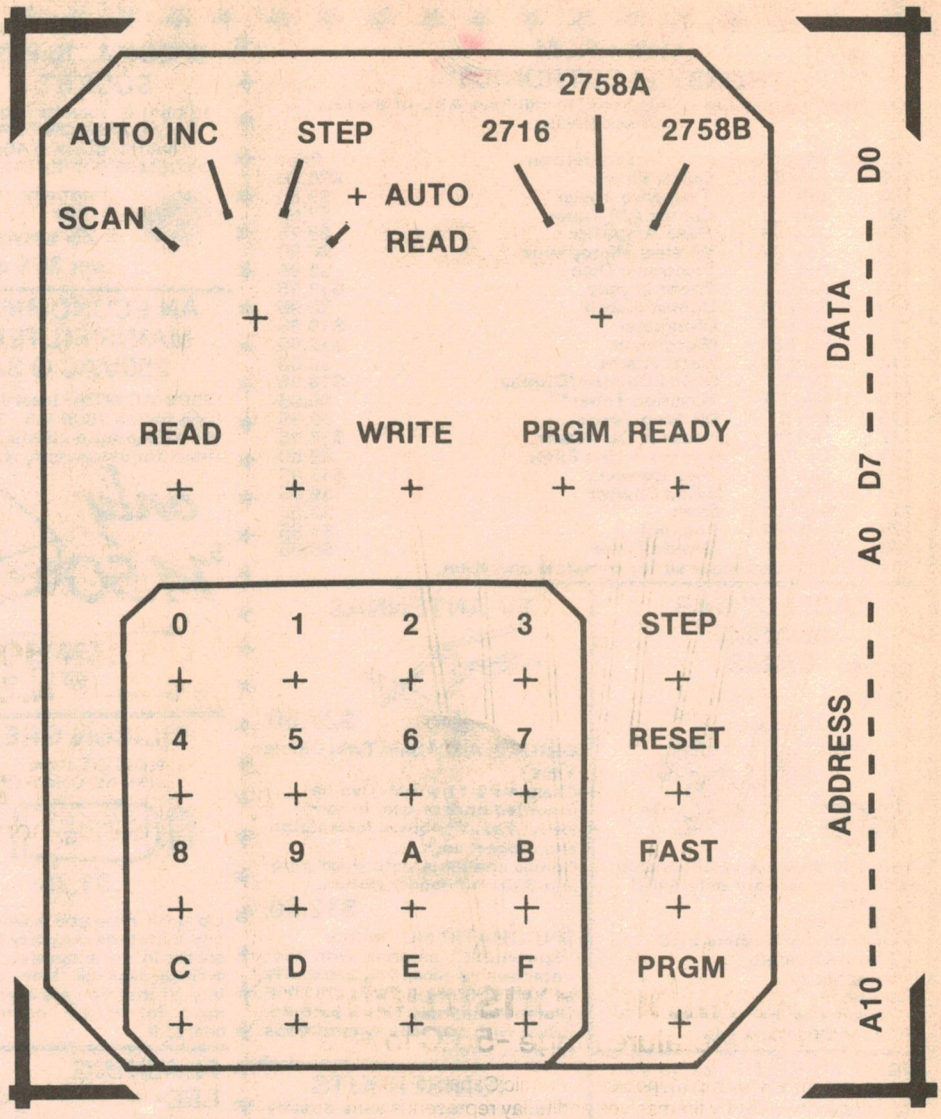
With the Read/Write switch in the Write position, check that the correct LEDs light with the hex keypad. Note that at the first depression of a key, both 4-bit data LEDs will show that code for the key pressed. On the second depression, the least significant 4-bit LEDs will show the code for the second key pressed, and the most significant 4-bit data LEDs will remain lit with the previously entered first key entry.

The Auto Inc and Step + Auto Read positions are used for programming. In the Auto Inc position, the address will increment at each depression of the PRGM switch. In the Step + Auto Read position, control of the Read/Write LEDs is automatic. Upon entering data, the Write LED will be lit and data can be programmed into the EPROM. As soon as the PRGM pulse is completed, the Read LED will light and the programmed location will be verified since we are reading the programmed data.

Now the erased EPROM can be inserted into the socket. Reset the address and with the mode switch in the Step position read the contents of the first address of the EPROM. Enter the required data with the keypad, apply the PRGM pulse, switch to Read and check that the location was programmed. Now that you have programmed the first location, the Step switch can be used to increment the address and the next location programmed. Of course, any of the three modes can be used for programming.

One final point: whenever the programmer is first switched on, always make sure that the PRGM Ready switch is off before power is applied. This ensures that no false programming occurs; it is always a good idea to keep this switch off until programming is required.

FRONT PANEL ARTWORK



Actual size artwork for the front panel. The PCB artwork has been omitted because it is too big to satisfactorily fit on a single page.

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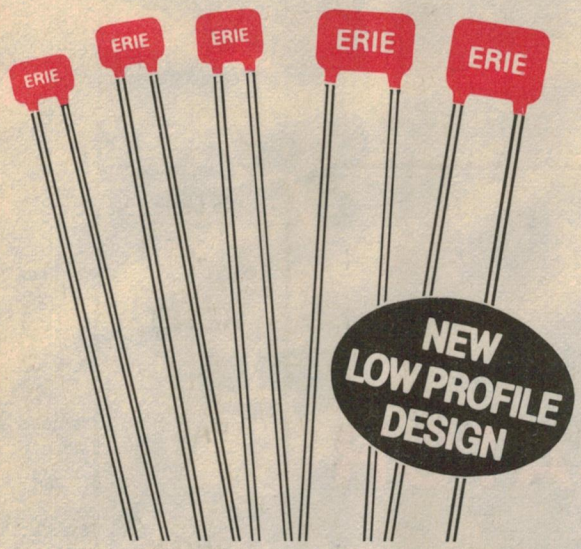

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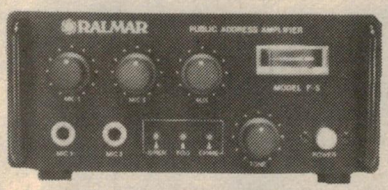

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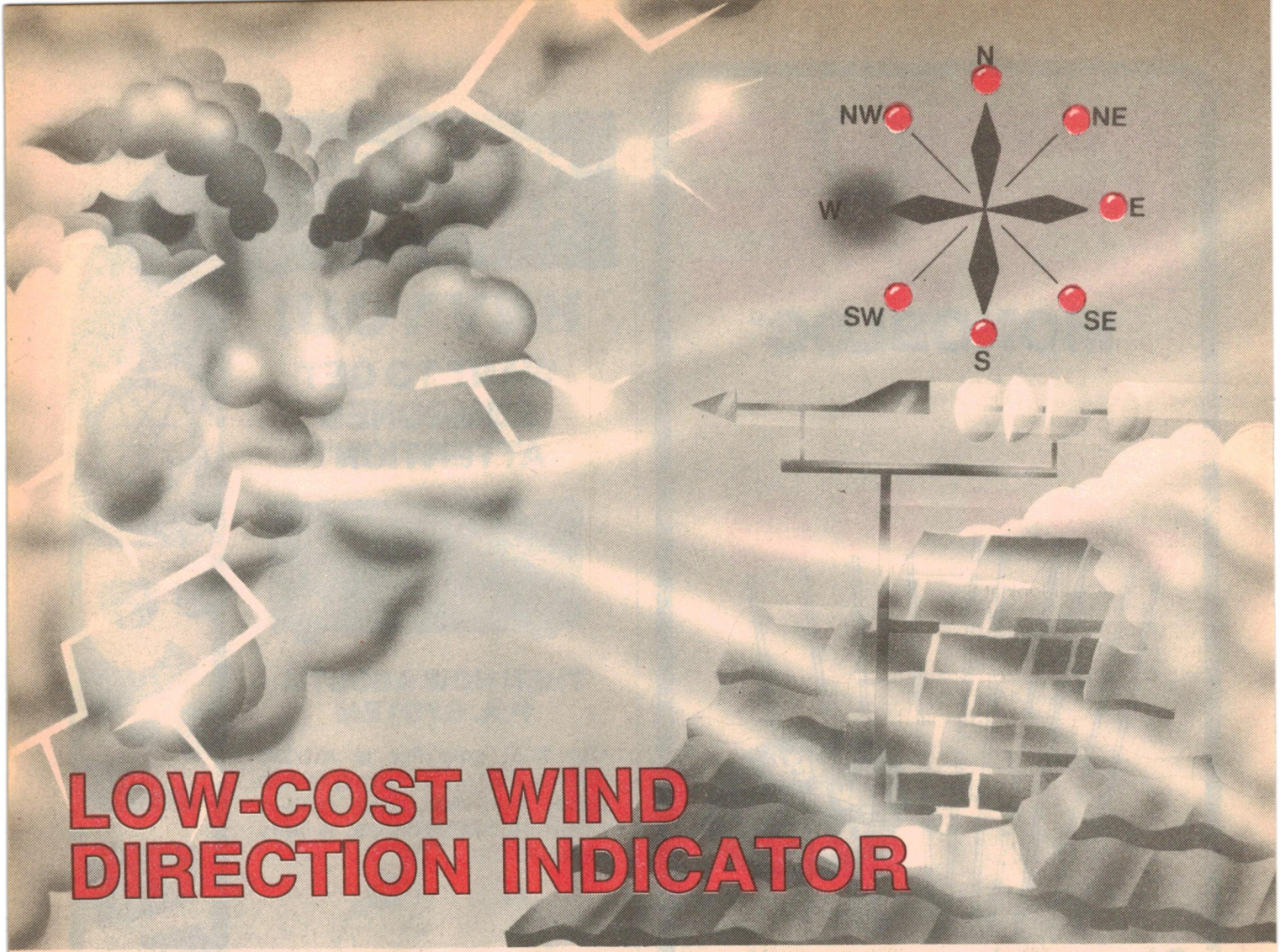


LOW-COST WIND DIRECTION INDICATOR

Add this simple wind direction indicator to the anemometer published in our August 1981 issue to obtain a complete wind speed and direction indicator. The circuit gives wind indication at eight points of the compass with only two wires between the remote sender and the electronic indicator.

By JOHN CLARKE

Knowing wind speed is only half the story. In most instances, it is just as important to know wind direction (or apparent wind direction) as well, particularly if you are involved in flying or boating activities. Wind direction is vitally important to parachutists, hang glider pilots and model enthusiasts, while no weather forecaster would dare give a forecast without this vital piece of information.

In fact, knowing wind direction can be more important than the actual wind speed. Consider for example, the case of stalking a rhinoceros with your camera. It is vitally important to be down wind, lest the rhino picks up your scent and charges you. (This guy shows imagination – Ed.)

But enough flippancy. Our new "Wind Indicator" is a practical device likely to interest a diverse range of people. It can be built for a fraction of the cost of current commercial units and could even form the basis of your own home weather station.

HOW IT WORKS

There are many traditional methods of measuring wind direction, including the old wet-finger-in-the-air trick, balloons, wind socks and mechanical wind vanes. The version described here is essentially a mechanical wind vane, to which we have added electronic position sensing linked to an electronic readout. This enables you to measure both the speed and direction of the wind without ever venturing outdoors.

We opted for a wind vane to detect the wind direction since it is relatively easy to incorporate sensors to detect the position of the vane. As can be seen from the photographs, the vane is similar to the tail of an aircraft and is supported on a bearing that rotates in the horizontal plane. When the wind changes direction, the vane rotates until equal wind pressure is applied to both sides of the tail – ie when the counterweight is pointing into the wind.

The electronic position sensors consist of reed switches arranged radially around the vane spindle to represent the points on a compass. A magnet attached to the spindle activates the nearest reed to give the appropriate front panel display. If the magnet subsequently changes position due to a wind change, the reed switch is released and a new reed activated.

With this arrangement, it is quite easy to use the reeds to independently activate LEDs arranged in a corresponding pattern. All we would have to do is connect a LED in series between each reed switch and ground, and run the other ends of the reeds to a common power supply rail. The drawback with this system, however, is that nine separate leads must be connected between the vane and the display unit, one for each reed plus a common.

For the average constructor, running a nine-lead cable between the vane and an indoors display unit is a rather messy prospect. The cable tends to be bulky and can become quite expensive,

particularly where long runs are used.

A far better method is to use the reeds to switch resistors in a voltage divider string. Extra circuitry is then used in the display unit to decode the voltage levels from the divider and to light the appropriate LED. This allows us to use only two wires between the vane and the display unit and, as a bonus, we can eliminate one of the reeds. More about this later.

CIRCUIT DESCRIPTION

The circuit can be divided into two distinct sections: a UAA170 dot display driver IC and a voltage divider circuit connected to pin 11. Seven resistors are used in the lower arm of the voltage divider, and each resistor can be shunted to ground by one or more of the reed switches. The UAA170 decodes the voltage set by the divider on its pin 11 input and drives the appropriate LED.

Let's take a closer look at the UAA170. Although the IC is rather complex internally, it is easy to use in practice.

First, pins 15 and 16 control the LED drive current. In this circuit, a 10kΩ resistor between pins 16 and 14 and a 1kΩ resistor from pin 15 to ground set the LED current to 20mA to ensure sufficient LED brightness.

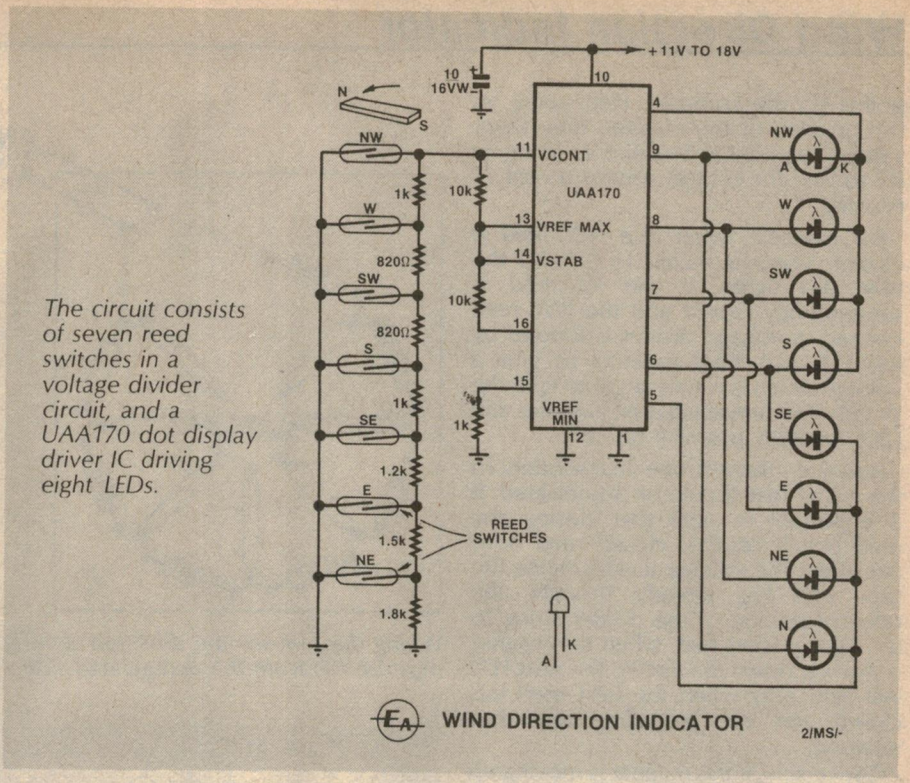
Pin 14 provides a stabilised voltage (Vstab) of 5V, and this is used as a reference level to program the IC. Two other pins (pins 12 and 13) are directly connected to 0V and Vstab respectively to set the minimum and maximum reference voltages (Vref min and Vref max). These minimum and maximum reference voltages determine the range over which Vcont (pin 11) must vary in order to light all the LEDs.

Cunning internal design ensures that there is always one LED lit for any voltage from Vstab to 0V and, in this circuit, that no two LEDs can be on at the same time. In practice, this means that there is a small voltage range over which Vcont can be varied while still keeping the same LED lit. When this range is exceeded, the next LED lights.

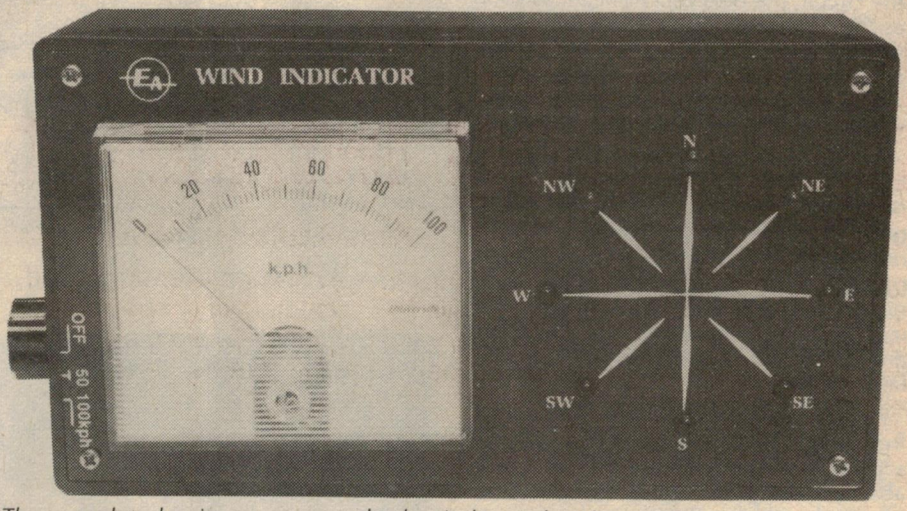
The voltage range over which each LED is lit is shown in Fig. 1, and is approximately 0.3V (5V divided by 16). Because the IC is designed to control 16 LEDs, the eighth LED (the N LED) will be lit when Vcont is at ½Vstab; or, more accurately, when Vcont is between ½Vstab and ½Vstab − 0.3V (see Fig. 1). So, in this circuit, Vcont has been set to a maximum value of slightly less than ½Vstab by the voltage divider network connected to pin 11.

The voltage divider consists of the 10kΩ resistor connected from Vstab to Vcont and the resistive divider string from Vcont to 0V. As we've just seen, the N LED is lit when all the reeds are open and Vcont is at maximum voltage. Result: no reed switch is required for the N position.

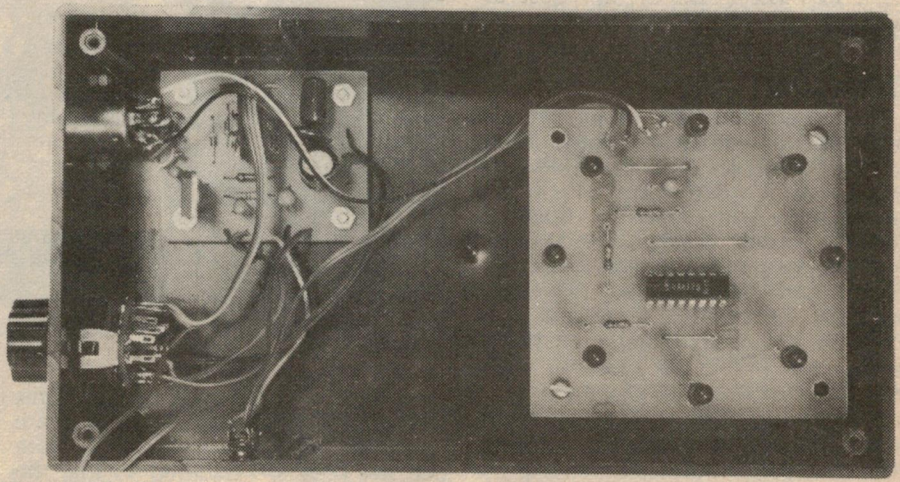
Thus only seven reed switches are required, one each for the remaining



The circuit consists of seven reed switches in a voltage divider circuit, and a UAA170 dot display driver IC driving eight LEDs.



The completed unit can measure both wind speed and wind direction.



View inside the completed display unit. External connections to the direction and speed sensing units are made via a five-pin DIN socket (top, left).

points on the compass. Depending on the position of the magnet, they shunt various resistors in the divider string to 0V to vary the control voltage on pin 11 (Vcont).

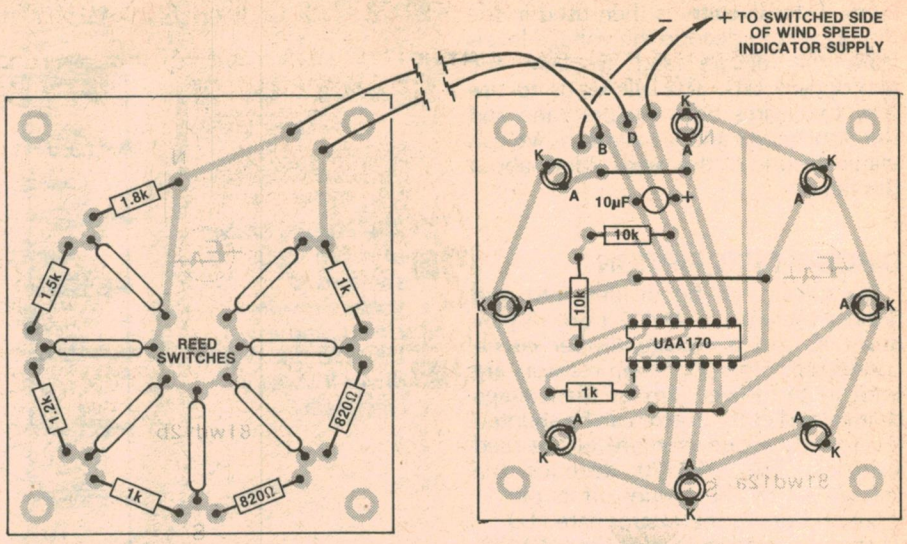
For example, when the NW reed is closed, Vcont is pulled to 0V and the NW LED lights. If the W reed is subsequently closed and the NW reed opened, a voltage divider is formed by the 1kΩ and 10kΩ resistors to give a voltage which is within range to light the W LED. The remaining reed switches and LEDs function in similar fashion.

However, there is one final subtlety to the circuit that should be appreciated. It is important to note that closing any reed below another closed reed does not affect the voltage divider, since the top reed has already brought the relevant section of the divider string to 0V. This ensures that, when the magnet is moving down the circuit, the next LED will light only when the next reed has closed and the preceding reed has released.

Conversely, if the magnet is moving up the circuit, the next LED will light as soon as the next reed is closed, regardless of whether or not the preceding reed has released. In other words, whenever two reeds are closed, the top reed always dominates and only one LED can light.

What this means in practice is that we can physically arrange the magnet and reed assembly so that slight overlapping occurs at the transition point – ie the next reed is activated just before the preceding reed is released. If this were not done, all the reeds would be momentarily open at the transition point and the N LED would flash on to give a false reading.

Power for the circuit can be derived from any 11-18V DC supply capable of supplying around 25mA. The unit will also operate quite happily from a 9V DC plugpack, which will have an output of about 12V at this low current. A 10μF capacitor across the supply provides decoupling.



Wiring diagram for the direction sensing and display circuits. Note that the circuit must be run from the unregulated side of the power supply (see p51, Oct, 1981).

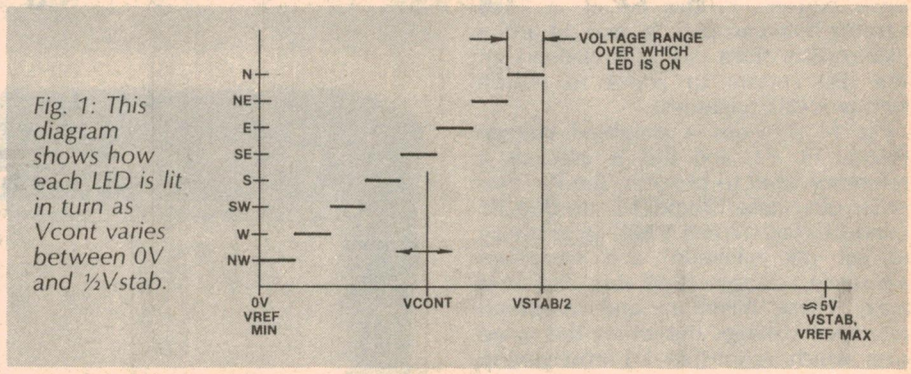
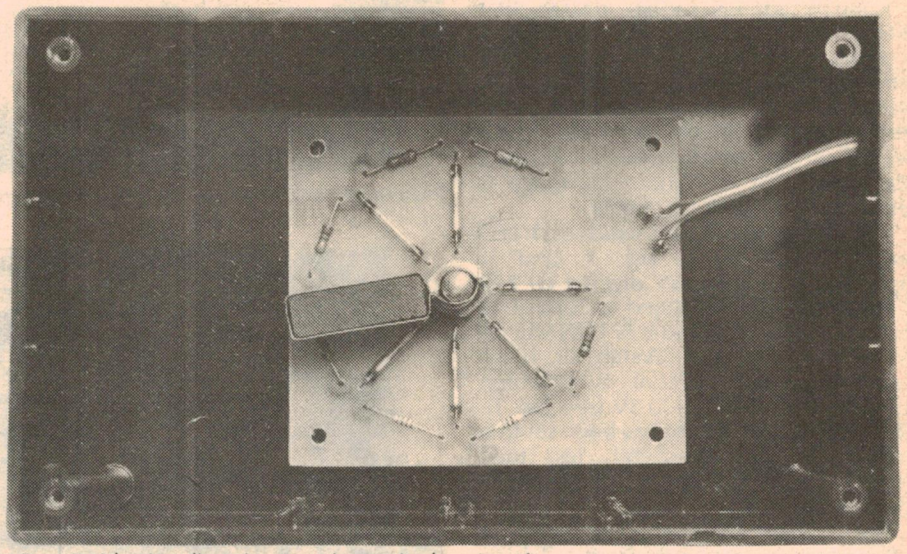


Fig. 1: This diagram shows how each LED is lit in turn as Vcont varies between 0V and ½Vstab.



View inside the direction sensing unit showing the magnet and reed assembly.

CONSTRUCTION

We constructed the circuit on two separate printed circuit boards (PCBs) coded 81wd12a and 81wd12b and measuring 77 × 77mm and 64 × 80mm respectively. The 81wd12a board is housed in the original Wind Speed Indicator case and supports the IC and LED display. The other board, 81wd12b, supports the resistor string and reed switches and is mounted in a plastic utility case (150 x 90 x50mm), along with the vane and magnet assembly

The first step is to construct the PCBs according to the wiring overlay diagrams. Be careful when bending the leads for the reed switches since the glass envelope is easily broken and make sure that all polarised components (LEDs, IC and tantalum capacitor) are connected the right way round. Note that the LEDs are soldered so that the top of each LED is 20mm above the PCB.

Once the PCBs are complete, they can be mounted on their respective cases. First, remove the old Scotchcal label from the Wind Speed Indicator case and fit the new label. Drill the holes for the meter and LEDs and mount the 81wd12a PCB on 38mm (2 × 19mm) standoffs so

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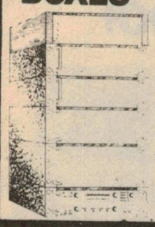

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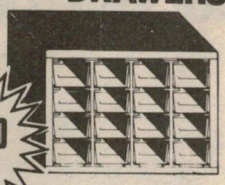

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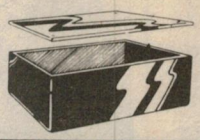

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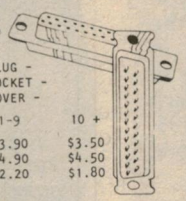

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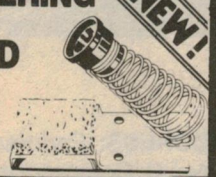

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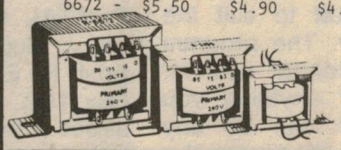

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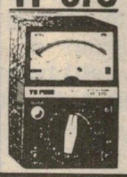

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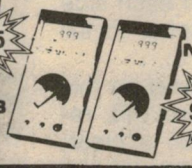

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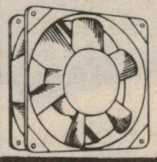

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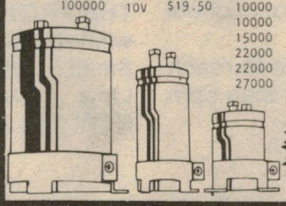

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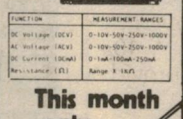

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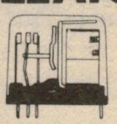

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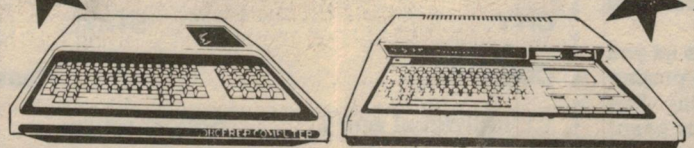

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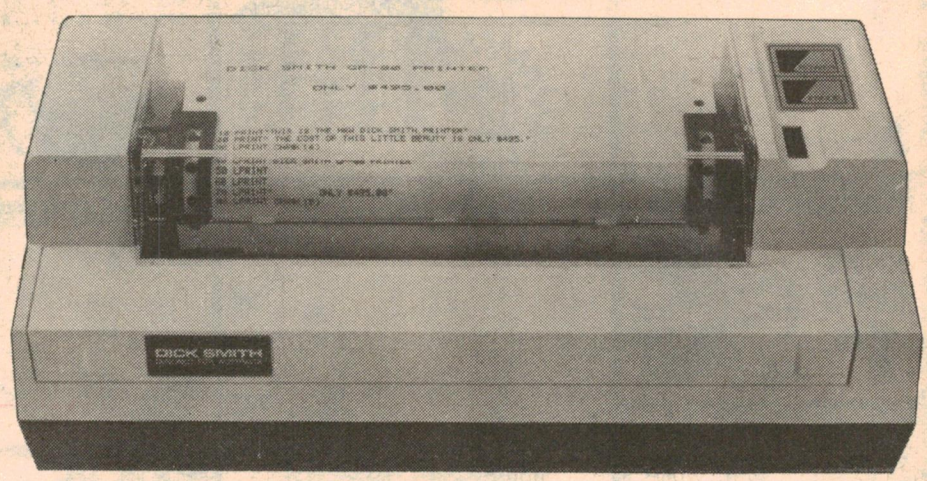
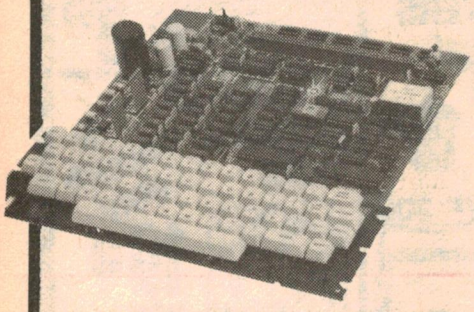
WIN A PRINTER!

for yourself or your school

To celebrate the runaway success of the Super-80 computer featured below, Dick Smith Electronics is sponsoring a competition with two DSE GP-80 printers as the prizes. (We reviewed this printer in our July 1981 issue and found it to be a little beauty.) If you have an interest in the Super-80 or computers in general you could win one of these nifty printers which have a retail value of $495. Win one for yourself or one for your school.





Note: This competition was previously announced in the November 1981 issue.

Conditions & what to do:

WRITE A PROGRAM to suit the Super-80 Computer. The program can be a game, control system, graphics display or anything you want. The program can be any length as long as it will fit into the maximum of 48K RAM on the Super-80 board.

SEND A C60 CASSETTE with one copy of your program on each side and WRITE a covering letter to tell us what it does.

COMPLETE the entry panel on this page or, in states where this requirement is illegal, make a clear, same-size photostate copy of the panel and enclose it with your program cassette. You may enter as an individual or on behalf of your school group.

POST YOUR ENTRY so as to reach our editorial office no later than 5pm on February 15, 1982.

POSTAL ADDRESS: Endorse your entry "Super-80 Competition" and post to Electronics Australia, PO Box 163, Chippendale 2008. Our street address: 57 Regent Street, Chippendale (near Central Railway).

JUDGING will be performed by the editorial staff of Electronics Australia. Chance will play no part in determining the winners. The judge's decision will be final and no correspondence will be entered into and no interview will be granted.

THE WINNERS will be notified accordingly and names will be published in the April 1982 or a subsequent issue of Electronics Australia.

THE PRIZES will be supplied to the winners, by arrangement, by Dick Smith Electronics, Cnr Waterloo and Lane Cove Roads, North Ryde, NSW 2113.

OTHER CONDITIONS:
Entry to this competition is open to all residents and school groups in Australia and New Zealand with the exception of employees and their immediate families of Magazine Promotions, John Fairfax & Sons Ltd, Dick Smith Electronics and their associated advertising agencies and publications.
You may enter as many times as you wish. All entries become the property of Electronics Australia. The prizes are not redeemable for cash.

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☐ **Individual entry** ☐ **School entry**

that the LEDs protrude through the lid of the case.

As shown in the photographs, the power/range switch must be relocated from its original front panel position to the side of the case. Mount it carefully so that the marking on the knob will coincide with the positions marked on the Scotchcal label.

The wiring for the display unit can now be completed. The positive supply rail for the new PCB is taken from pin 7 of switch S1 (see October issue), while the 0V rail can be obtained from the negative side of the meter or from the negative side of the power input socket. The other two leads, labelled B and D on the overlay diagram, are connected to spare terminals on the DIN socket.

VANE ASSEMBLY

Fig. 2 shows the basic scheme for the vane and reed switch assembly. As can be seen, the tail is made from 0.5mm sheet aluminium while the counterweight and brackets are made from 3mm aluminium. Cut out the tail piece first, then fashion the brackets by bending them around the knob and by using pliers to straighten the ends. Secure the tail piece to the brackets using rivets or machine screws and nuts.

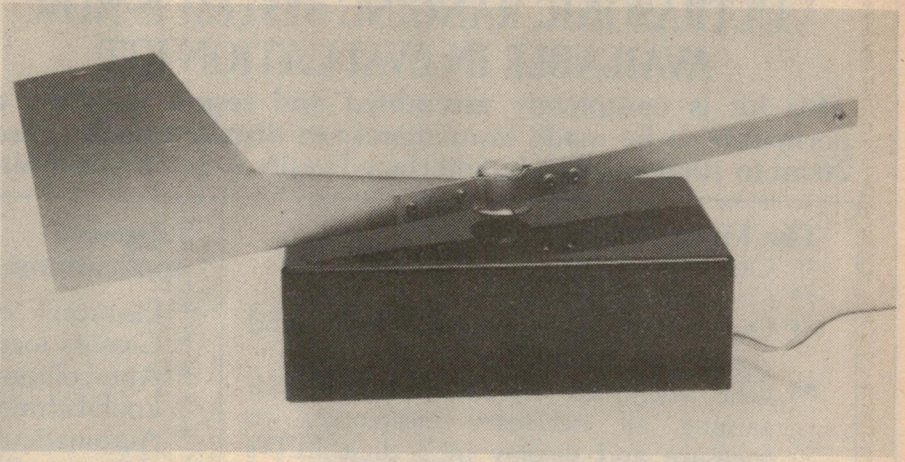
Note that an access hole should be drilled in one of the clamps opposite the knob grub screw. This will enable you to tighten the screw when the knob is subsequently placed on the spindle.

The counterweight can now be made and should be cut to length to balance the tail. Cut it longer than necessary at first and attach it to the rest of the assembly. The counterweight can then be trimmed until the setup balances on a pivot placed in the hole of the knob.

A dial-drive spindle is used as the bearing for the vane and is attached to the 81wd12b PCB by screwing it into a nut soldered to the component side of the board (see Fig. 2). The spindle thread protrudes through a central hole in the base of the case (the case is used upside down) and the whole assembly secured by a second nut on the outside. Note that the component side of the PCB faces into the case.

The magnet holder is made of solderable sheet metal (eg, tin plate). Bend the metal tightly around the magnet and solder the two ends together as shown in Fig. 2. The two free ends are then bent around the spindle and soldered together for a tight fit. Finally, the magnet can be glued in the holder using epoxy resin and the completed magnet assembly glued (or soldered) to the spindle.

Alternative methods of holding the



Close-up of the completed vane assembly mounted atop the direction sensing unit. The view at the bottom of the page shows how the direction and speed sensors were mounted on a mast.

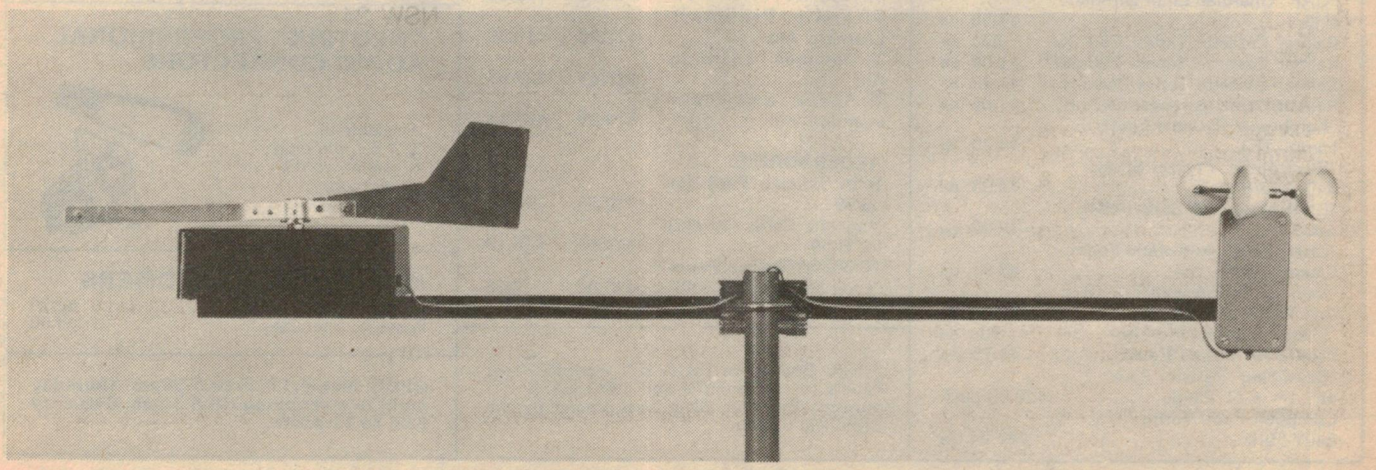
PARTS LIST

1 knob
1 sheet of aluminium, 0.5mm × 153 × 75mm
1 160mm length of 12 × 3mm aluminium bar
1 magnet, 8 × 27 × 8.5mm
1 brass dial drive spindle and two nuts
4 19mm standoffs
6 PC stakes
1 printed circuit board, code 81wd12a, 77 × 77mm
1 printed circuit board, code 81wd12b, 64 × 80mm
1 Scotchcal front panel, 107 × 192mm
1 plastic utility case, 150 × 90× 50mm

COMPONENTS
1 UAA170 LED dot display IC
8 5mm red LEDs
7 reed switches, 15mm long
1 10µF/16VW electrolytic capacitor

RESISTORS (¼W, 5%)
2 × 10kΩ, 1 × 1.8kΩ, 1 × 1.5kΩ, 1 × 1.2kΩ, 3 × 1kΩ, 2 × 820Ω

MISCELLANEOUS
Cable, screws, solder, hook-up wire etc.



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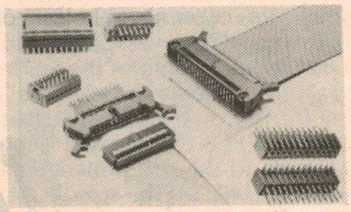

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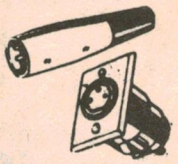

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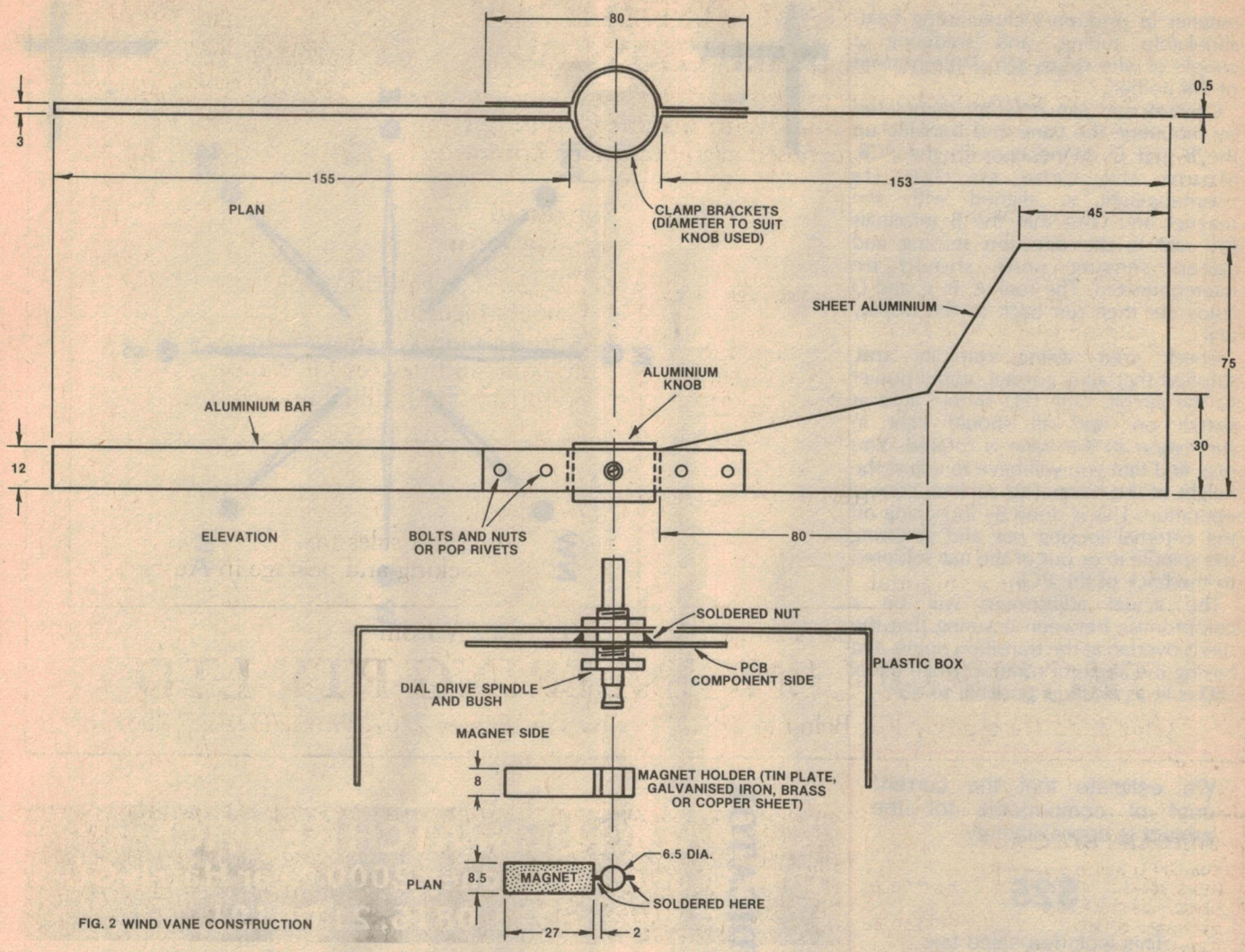
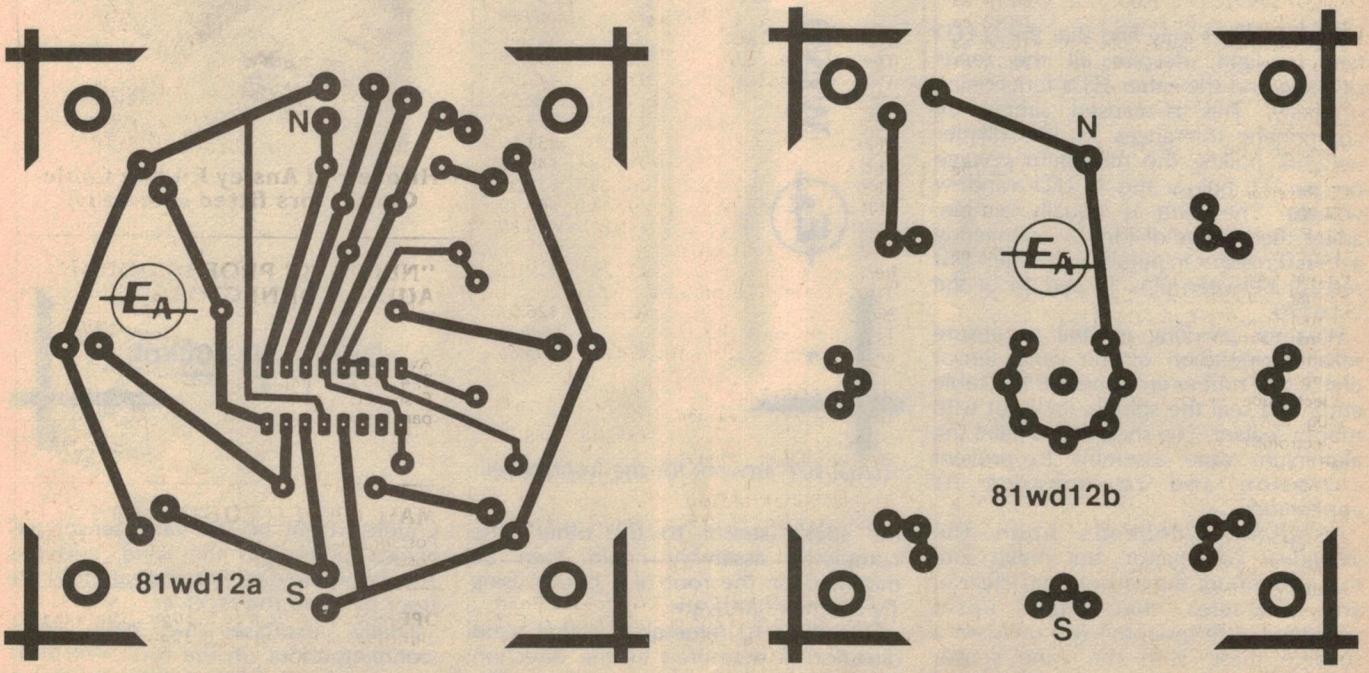


FIG. 2 WIND VANE CONSTRUCTION

This metalwork diagram shows the construction details for the aluminium vane.



Here are actual size artworks for the two PCBs. Finished boards will be available from the usual retail outlets.

magnet in position include using heat-shrinkable tubing, and soldering a couple of wire straps across the bottom of the holder.

Construction can now be completed by mounting the vane and hooking up the B and D connections to the PCB. Mount the vane so that its counterweight is aligned with the magnet and note that the B terminals (0V rail) in the direction sensing and speed sensing units should be interconnected. The four A, B, C and D leads are then run back to the display unit.

Check your wiring carefully and, satisfied that all is correct, apply power to the circuit. One LED should light at switch on, and all should light in succession as the vane is rotated. You may find that you will have to adjust the height of the magnet to achieve correct operation. This is done by loosening off the external locking nut and screwing the spindle in or out of the nut soldered to the back of the PCB.

The actual adjustment will be a compromise between ensuring that the reeds overlap at the transition points and having the angle of rotation while the N LED is lit as close as possible to 45°.

We estimate that the current cost of components for the project is approximately

$25

This includes sales tax.

Some readers may find that the N LED fails to light, despite all the reeds opening and the other LEDs functioning normally. This is caused simply by component tolerances in the divider network pulling the maximum voltage on pin 11 below the N LED window voltage. The cure is equally simple: adjust the voltage divider by connecting a 150kΩ resistor in parallel with the 10kΩ resistor between pins 11 and 14 of the UAA170.

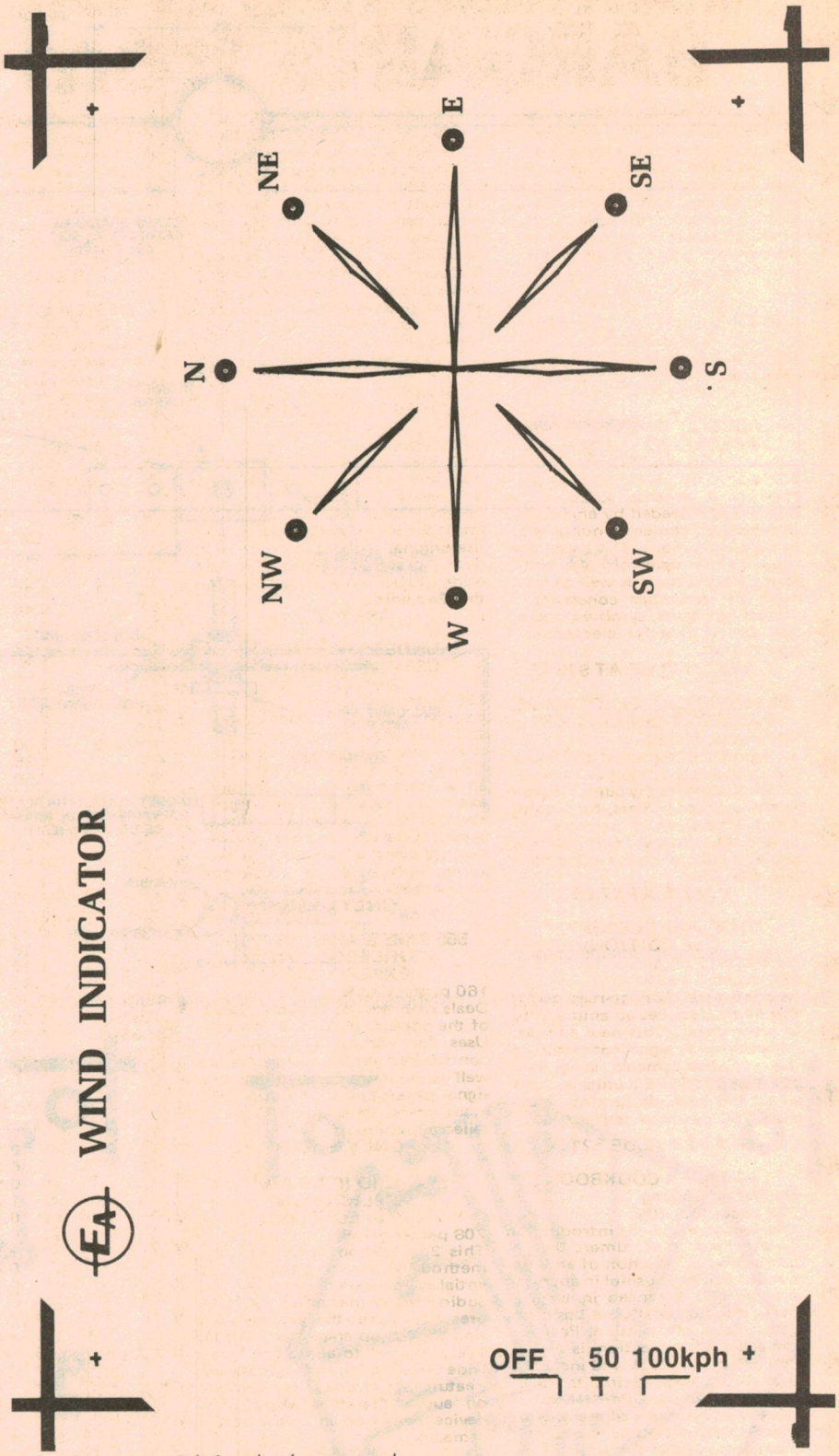
Weather proofing is vital to ensure reliable operation of the vane sensor unit. Use a rubber grommet for the cable entry and seal the spindle lock nut with rubber sealant. You should also paint the aluminium vane assembly to prevent corrosion and to enhance its appearance.

Installation depends upon the individual constructor, but make sure that you mount the sensor units clear of any obstacles that might upset operation. We mounted our units on a suitable mast, with the vane sensor bolted to one end of the cross-arm and the speed sensor to the other. The completed assembly could then be mounted on the roof of a house using TV-antenna hardware.

One thing to remember is that wind direction is measured as the direction from which the wind is coming. The counterweight on the vane sensor will always point into the wind, and this should be the direction indicated on the front panel of the receiver.

Finally, exercise due care when stomping about on the roof. We don't want any broken bones now, do we?

FRONT PANEL ARTWORK



Actual size artwork for the front panel.

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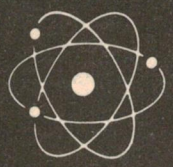
Simple metronome uses two transistors

Basic Electronics



Over the past 12 months or so we have had quite a few requests for a simple metronome circuit. This new circuit has low current drain and drives a loudspeaker as well as a LED indicator and even at maximum volume from the loudspeaker the current drain is still less than one milliamp.

by PAUL DE NOSKOWSKI

Some five years have elapsed since we last published a design for an electronic metronome – in the July, 1976 issue, to be precise. That unit featured an accented beat, wherein certain clicks in the sequence are accentuated to simulate the down-beat at the beginning of each musical bar. However, this increases the complexity of the circuit, and is reflected in both increased expenditure for parts and increased battery consumption.

In our new simplified design, we have been able to keep the battery drain down to less than 1mA!

Most readers will at some time or other have heard or seen a conventional mechanical metronome, which is built into a pyramidal shaped case containing a clockwork escapement mechanism. A spindle emerging from the base end supports an upright pendulum, carrying a brass weight, which can be locked into the desired position. When set in motion, the pendulum oscillates from side to side producing an audible click.

Both the visual movement and audible click serve as a guide to musical tempo, or beat. The tempo range covered by a mechanical metronome is usually between about 40 and 170 beats per minute, and is varied by sliding the brass weight up and down the pendulum, with the rate being displayed on a calibrated scale on the body (behind the pendulum).

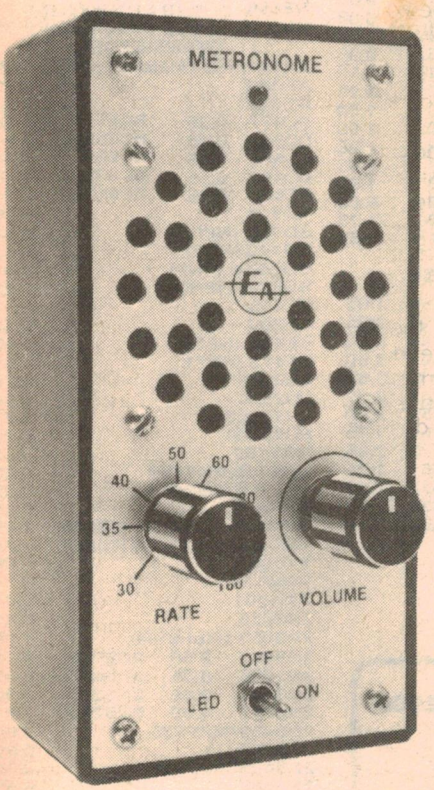
The two main requirements in a metronome are that the rate at which the clicks occur should be constant and repeatable, and that the clicks should be "non-musical" in character.

In this latest design we have used a programmable unijunction transistor (PUT) as the basic oscillator, since it can perform almost as well as a 555 timer in the areas of temperature and voltage stability, yet consumes far less supply current (which is about 5mA in the case of the 555). We also considered using a 7555 (the "CMOS" version of the ubiquitous 555), which only draws some 100μA, but rejected it on the grounds of increased cost and somewhat limited availability.

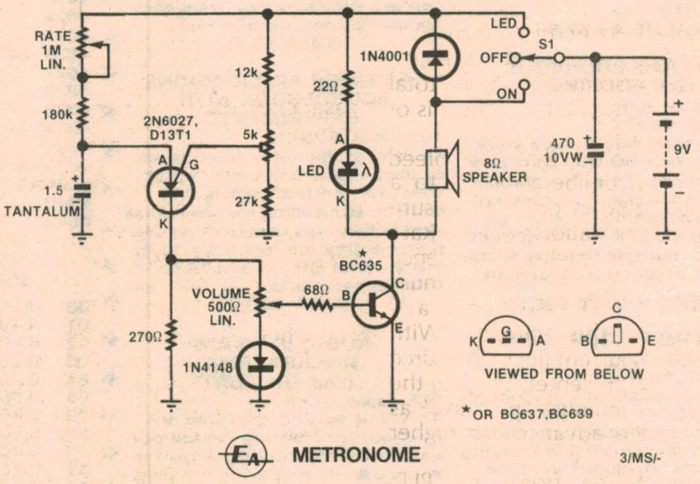
A PUT is really not a unijunction transistor at all but is actually a special low current type of silicon controlled rectifier (SCR) which has an anode gate instead of a cathode gate. A conventional SCR with cathode gate requires that its gate be raised about 0.5 volts above its cathode in order for it to conduct.

An anode gate SCR is different in that it requires that its anode be raised above its anode gate by about 0.5 volts (or thereabouts) for it to conduct. This enables it to be used in relaxation oscillator circuits and give improved performance compared to a unijunction transistor.

In our circuit the PUT has its gate connected to a preset voltage provided by an adjustable divider consisting of a 5kΩ trimpot and two resistors. When power is applied to the circuit, the 1.5μF capacitor begins to charge via the 180kΩ



Our new metronome features a level control and has an output of between 30 and 160 beats per minute.



The circuit uses a 2N6027 programmable unijunction transistor as the oscillator.

resistor and 1MΩ "rate" control potentiometer. When the voltage across the 1.5μF capacitor rises just a little above the preset gate voltage, the PUT suddenly breaks into conduction and dumps the capacitor charge across the 270Ω resistor connected to its cathode. When the capacitor is fully discharged (in about one millisecond) the PUT switches off and the cycle can repeat itself. Thus the circuit is a classic example of a relaxation oscillator, with the voltage waveform being a sawtooth (slowly rising ramp and rapid decay) with an amplitude controlled by the preset voltage. At the same time, there is a string of positive pulses appearing across the 270Ω cathode load resistor.

By varying the setting of the rate control, we can vary the frequency of the sawtooth waveform across the capacitor and the rate of the pulses across the cathode resistor. At the same time, the 5kΩ trimpot allows us to accurately set the sawtooth frequency for a particular setting of the rate control. The accompanying oscilloscope photograph shows the voltage waveforms at the anode and cathode of the PUT.

Virtually no current is drawn by the PUT during the charging segment of the oscillator cycle; and when the PUT conducts, the stored charge in the tantalum capacitor provides the anode/cathode current flow. Thus the current drawn from the supply is the sum of charging current and the "bleed" current flowing through the gate biassing network. Charging current will be dependent on the setting of the Rate control, varying between approximately 6μA and 35μA – typically about 20μA. As bleed curent is some 200μA, the total current drawn by the PUT oscillator is of the order of 220μA.

It should be noted that the bleed current has been deliberately set to a relatively high value in order to ensure satisfactory PUT oscillation with the Rate control set to the highest frequency (minimum resistance), when minimum performance PUT devices are encountered in this circuit. With insufficient bleed current (ie, high source impedance being presented to gate) the oscillator will commence "misfiring" as the Rate control is advanced to higher repetition rates.

The output pulses from the PUT cathode are used to drive a single transistor which acts as a rudimentary amplifier stage to drive a LED and a small loudspeaker. The volume of this amplifier stage is controlled by feeding the pulse waveform into the transistor base via a 500Ω volume control potentiometer and 68Ω limiting resistor.

A 1N4148 diode is connected in series with the volume control. If this diode was omitted, there would be a noticeable "dead spot" at minimum settings of the control due to the fact that the transistor does not begin to conduct until the voltage applied to its base exceeds around 0.6V. The diode compensates for this in the following way:

When the output pulse voltage appears at the cathode of the PUT, it is divided so that about 0.6V appears across the 1N4148 diode and the remainder of the pulse voltage appears across the 500Ω volume pot. This means that when the volume control is set fully anticlockwise, the transistor will barely conduct when each pulse appears but the loudness of the clicks from the loudspeaker will increase progressively as the volume control is advanced. And this system works well no matter how "sick" the battery becomes and how weak the PUT output pulses become.

As a matter of fact the PUT will continue to oscillate at battery voltages down to about four and a half volts although at this level, the available loudness from the loudspeaker is quite restricted.

We arranged the on/off switch to select either the LED alone or both LED and loudspeaker. When the on/off switch feeds the power directly through to the loudspeaker load for the transistor, the rest of the circuit is fed via the 1N4001 diode, so that the LED flashes each time a click sounds from the loudspeaker. When the LED is selected, the diode blocks current to the loudspeaker which is silenced. The on/off switch is a single-pole, double throw type with a "centre-off" position.

Readers may wonder why the 470μF capacitor is connected directly across the battery instead of on the circuit side of the on/off switch. The capacitor is intended to supply the brief pulses of current to the loudspeaker which the battery becomes increasingly incapable of doing as it ages. In other words, the capacitor ensures a low supply impedance. But the reason the capacitor is connected directly across the battery is an interesting sidelight to this project.

In our original prototype the capacitor was wired between the junction of the diode and loudspeaker, and the 0V side of the circuit. However, we found that when the LED only function was selected by the on/off switch, the loudspeaker continued to produce clicks. At first we could not understand how this could happen since the loudspeaker was supposedly isolated from the supply. But in actual fact, it wasn't!

What was actually happening was that in the comparatively long "off" time

PARTS LIST

1 "zippy" box, 130 x 68 x 41mm
1 Scotchcal panel label
1 printed circuit board 81mi11, measuring 57 x 35mm
1 "small" 8Ω loudspeaker (57mm diameter)
1 9 volt battery,
1 battery retaining clip
1 clip lead set for battery
1 SPDT (centre "off") toggle switch
2 knobs

SEMICONDUCTORS

1 small red LED (3mm diameter)
1 1N4001 diode
1 1N4148 doide
1 2N6027 (D13T1) programmable unijunction transistor
1 BC635 (or BC637, BC639) small signal transistor

CAPACITORS

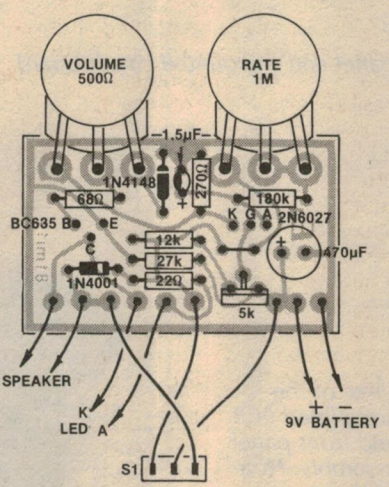
1 470μF 10 volt PC electrolytic
1 1.5μF 16VW tantalum electrolytic

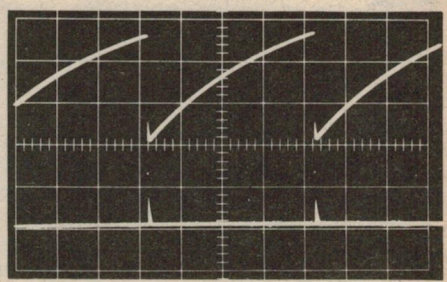
RESISTORS

(¼ watt, 5% carbon film)
1 x 180kΩ, 1 x 27kΩ, 1 x 12kΩ, 1 x 270Ω, 1 x 68Ω, 1 x 22Ω
1 1MΩ linear potentiometer
1 5kΩ vertical mount trimpot
1 500Ω linear potentiometer

MISCELLANEOUS

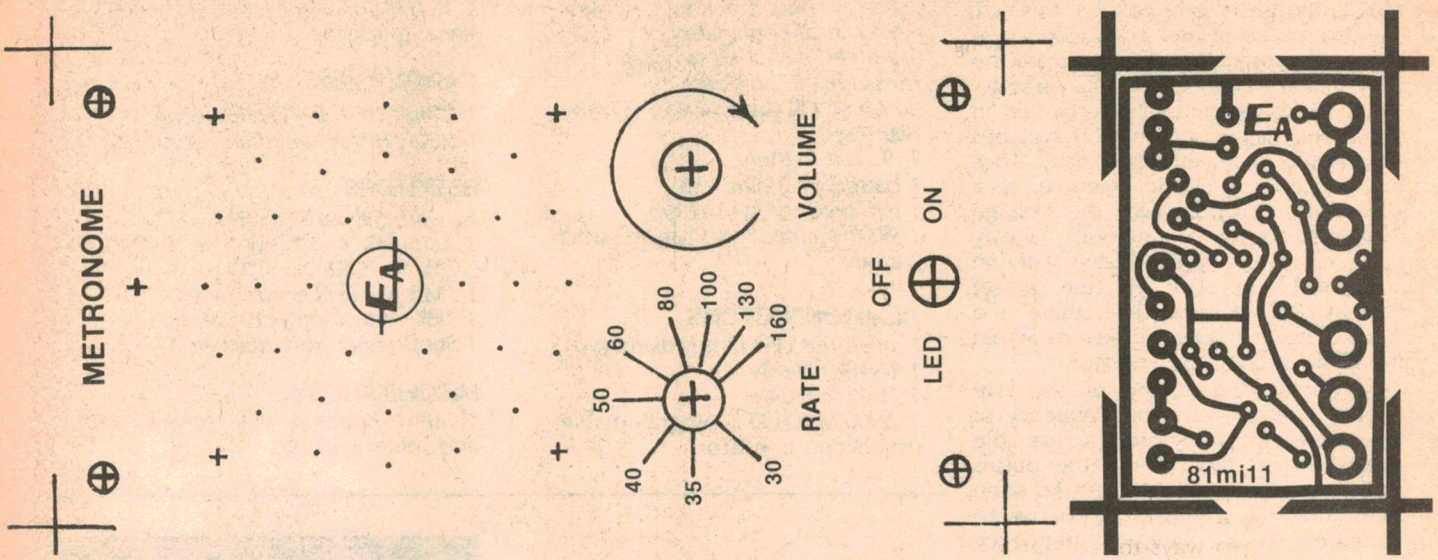
1 metre hook-up wire, screws, nuts and solder lugs etc.





This photograph shows the waveform at the anode and cathode of the PUT.

LEFT: the component overlay diagram. The volume and rate potentiometers are soldered direct to the PCB.

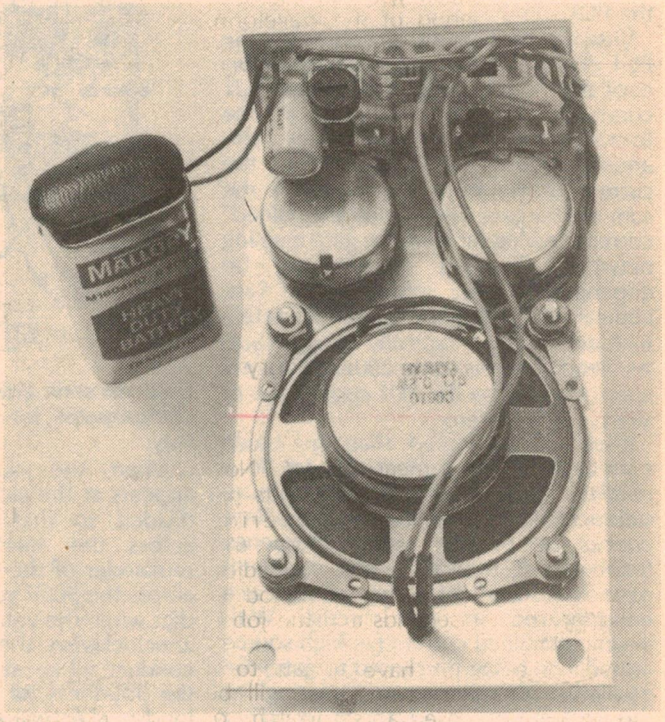


Here are actual size artworks for the front panel and the printed circuit board.

between each click, the 470μF capacitor was able to charge via the LED and loudspeaker, since the transistor was turned off. Then, when the transistor turned on, ostensibly only to light the LED, the capacitor was able to deliver a pulse of current to the loudspeaker. Very tricky! Therefore, the capacitor now resides permanently connected to the battery. The leakage current of the capacitor, by the way, can normally be expected to be around one microamp or so, which is hardly likely to reduce the battery life by a significant amount.

Current drain of the unit varies with volume control settings; at minimum setting only the PUT oscillator is functional, drawing some 220μA. At 120 beats (crotchets) per minute the average current consumption is around 850μA with the volume turned to maximum, and the metronome simultaneously driving LED and loudspeaker.

Having considered the operation of the circuit, let us now turn to its assembly.



View of the completed PCB and front panel assembly. Note how the loudspeaker is secured.

CONSTRUCTION

Our unit was built into a small plastic zippy box measuring 68(W) x 130(H) x 41(D)mm. The printed circuit board is coded 81mi11 and measures 57 x 35mm.

Commence construction by assembling the components onto the PC board. Install smaller components first, finishing with the capacitors and transistors. Follow the overlay provided to assist in the orientation and positioning of the components. Make sure that polarised items are correctly oriented, and that the resistor and capacitor values are as per the circuit. At this stage do not solder the potentiometers to the board.

The next step is to affix the self-adhesive Scotchcal label to the front panel, and drill the holes for the controls and loudspeaker.

Straighten the connecting lugs of the potentiometers so that they lie at right angles to the pot shafts and can be fed into the appropriate holes on the PC board. Note that it will probably be necessary to slightly crimp the ends of each lug to enable them to pass through the 3mm diameter holes in the PC board.

Now install the two potentiometers in the front panel, remembering that the 1MΩ pot is used for the Rate control, and the 500Ω for the Volume control. Ensure that the pots' connecting lugs are positioned to face towards the lower edge of the panel. Fit the assembled board to the pot lugs, and solder together.

The toggle switch, LED and loudspeaker may now be fitted to the panel. Note that four solder lugs, each secured with a screw and two nuts, hold the loudspeaker in position.

Wire up the LED, switch, loudspeaker and battery clip leads to the PC board, as per the component overlay diagram. Connect the battery, and switch the unit on. Providing the volume control is partly advanced, you should hear clicks at a rate set by the Rate control. Advance the Volume control further and check that the LED is flashing in time with

the audible clicks. Switch to LED only, noting that the LED continues flashing but the clicks are suppressed.

Assuming that your metronome is functioning as described above, you can now calibrate the Rate control. Firstly, fix its knob so that it can rotate equally past the 30 and 160 marks. There should be about 10 degrees of rotation past both marks. As this is a relatively simple instrument, we have only included a preset for adjusting the basic rate, and have omitted facilities for presetting end limits for the Rate control. Thus the "tracking" of the Rate control on your unit will be dependent on the tolerance match of the 1MΩ potentiometer and associated series 180kΩ resistor. For this reason it is desirable to perform the calibration at a rate which is in the centre of your most used range.

There are two ways to calibrate your metronome. First, if you have a frequency meter which can measure period (the latest EA design described last month is ideal) you can use it to measure the period of the waveform. Connect the frequency meter across the 270Ω cathode load resistor for the PUT and set the frequency meter mode control for period measurements. Now set the rate control for 100 beats per minute and note the period measurement. It should be 600 milliseconds or not far off. Now adjust the 5kΩ trimpot to get a period of exactly 600 milliseconds and the job is complete.

We estimate that the current cost of parts for this project is approximately

$17.00

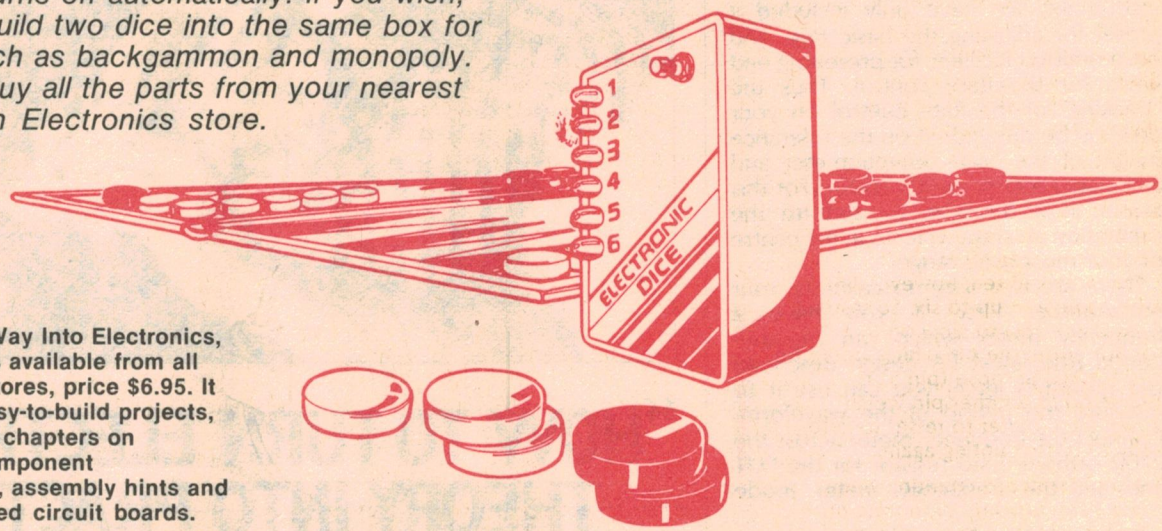
including sales tax and battery

Should you not have access to a suitable frequency counter, it will be necessary to use a stopwatch or wristwatch with sweep second hand. As previously, set the pointer to "100", turn the metronome on and count the clicks in, say, a one-minute period. Adjust the preset to obtain exactly 100 clicks (Hint: for coarse adjustment, count the clicks in, say, a 12-second period – should be 20 clicks – then use the one-minute period for the final fine adjustment).

The unit may now be screwed into its box, and is ready for use. One final thought: readers interested in photography can set the Rate control to 60 (one click per second), and use the audible clicks to tick off the seconds for "time" exposures at night or for printing sessions in the darkroom.

Simple Electronic Dice

Here's another great project which we've reprinted straight from Dick Smith's "Fun Way Into Electronics, Volume 2". It's an electronic dice that not only "rolls" and displays the result but then turns off automatically! If you wish, you can build two dice into the same box for games such as backgammon and monopoly. You can buy all the parts from your nearest Dick Smith Electronics store.



Note: "Fun Way Into Electronics, Volume 2" is available from all Dick Smith stores, price $6.95. It details 20 easy-to-build projects, and includes chapters on soldering, component identification, assembly hints and making printed circuit boards.

you will need these components

Resistors:

R1 22k ohms
R2 220k ohms
R3 1k ohms

Capacitors:

C1 .022uF ceramic
C2 33uF 10 volt electrolytic
C3 4.7uF 16 volt electrolytic

Semiconductor devices:

LEDs 1 – 6 small red LEDs
D1 1N4001 diode
IC1 555 timer integrated circuit
IC2 4017 CMOS decade counter integrated circuit
TR1 DS548 or similar NPN transistor

Miscellaneous:

PB1 Momentary contact press button switch
Battery snap, hook-up wire, solder, etc

You will also require a 9 volt transistor battery (not normally supplied with a kit) or some other DC power supply.

A suitable mounting board or printed circuit board of correct design (see text). DSFW2 K-2625 Electronic Dice kit contains the correct PCB.

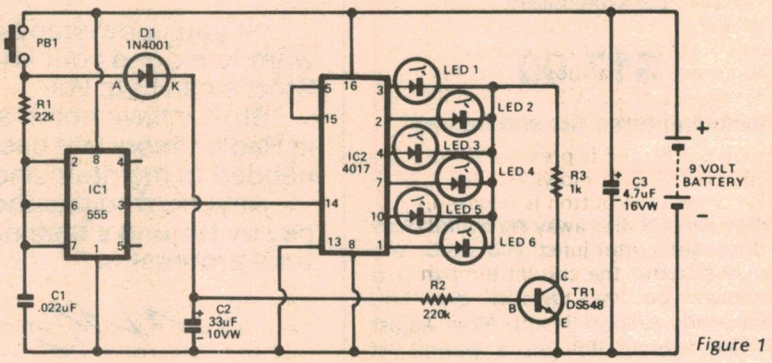


Figure 1

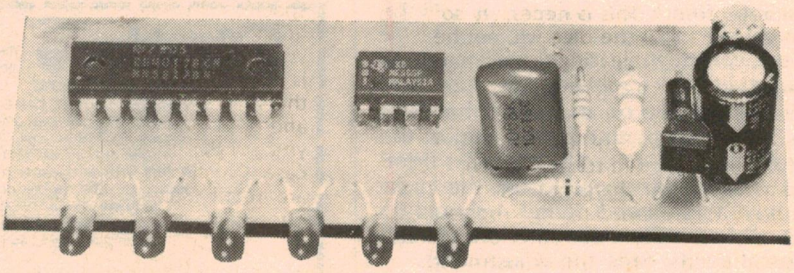


Figure 2

how it works

When the push button switch PB1 is pressed, power is supplied to C1 via R1. C1 gradually charges, until a certain voltage is reached where IC1 conducts, supplying a pulse to IC2 at the same time as it discharges C1. C1 then starts to charge again, repeating the process.

The combination of R1, C1 & IC1 is called a 'relaxation oscillator', as every time a pulse occurs, the circuit 'relaxes', ready to start over.

IC2 is a counter, which simply detects the pulses supplied by IC1 and counts them. It shows how many pulses it has counted by causing a LED to glow representing that number. This IC can, in fact, count to ten; however, we want it to count up to six. So instead of causing a LED to glow on the seventh pulse, the pin which would be used for this purpose (pin 5) is connected to another pin which causes the counter to re-set to zero, ready to start counting again.

The counter keeps counting while pulses keep arriving. When the push button is released, the oscillator stops and no more pulses are received. The counter then shows what it had counted to at that particular instant.

Because we do not want the LED to stay on indefinitely (wasting the battery), a separate circuit causes the LED to go out after a short time. This circuit consists of D1, C2, TR1 and its associated resistors.

Whilever the button is pressed, C2 is charged via D1. This allows TR1 to turn on. When the button is released, the charge in C2 dies away through R2 and the base/emitter junction of TR1. After a short time, the current through the transistor becomes too small to keep it conducting, so it turns off and the LED is extinguished.

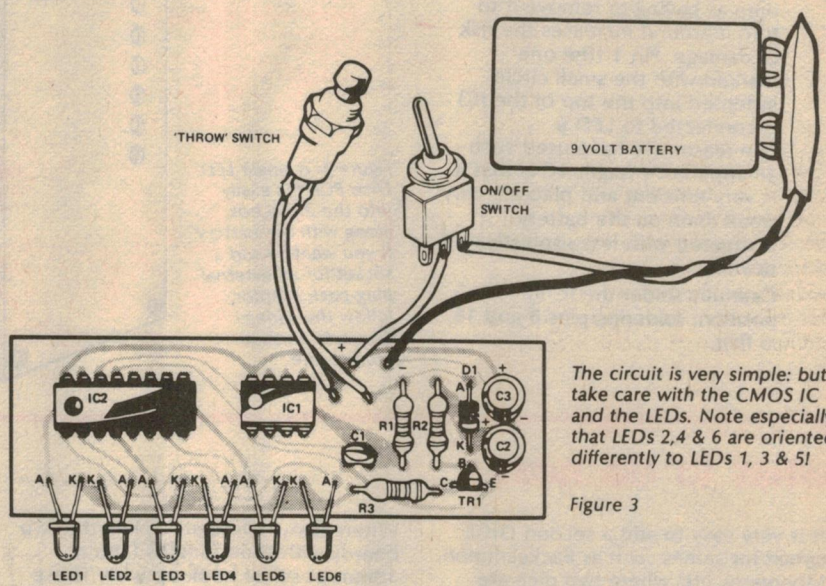
With the .022uF capacitor shown, the LEDs will flash in sequence so quickly that they all appear to be on at once (although dimly). This is necessary so that anyone using the dice will not be able to cheat by releasing the button at a certain time to obtain a certain number.

Increasing the value of R1 and/or C1 will cause this speed to slow down, due to the longer charging time required. Wired as a flashing brooch, with a 3.3uF capacitor in C1 and a link across the 'PB1' pads, the LEDs will flash slowly in sequence as long as the battery is connected.

putting it together

(1) If you have purchased a kit (Dick Smith Cat. K-2625 or similar), check off the components against the above list to make sure they are all there and are the correct types and values.

(2) If you have not purchased a kit you will need to obtain the components listed and either make a printed circuit board using the component position drawing as a guide, or use perforated or tracked board.



The circuit is very simple: but take care with the CMOS IC and the LEDs. Note especially that LEDs 2,4 & 6 are oriented differently to LEDs 1, 3 & 5!

Figure 3

(3) Mount the components as shown in the component position drawing, resistors and capacitors first, being careful to mount C2 and C3 capacitors the right way around as they are polarised. If you are building the brooch, C1 is also an electrolytic and requires the same caution as C2 and C3 in mounting. It is possible that in some cases you will have an axial electrolytic to mount on the PCB. If there is space provided between the holes you can mount it flat as you would a resistor, but if there is not, stand it up as shown in the section on 'Assembly hints and tips'. Take extra care that you get the polarity right in this case. Check that all components are neatly placed and properly 'dressed' before soldering them in.

(4) Solder in the six LED's making sure that they are the correct polarity – remember that the short lead is the cathode (K) also marked by the flat side of the LED. Keep all of the leads the same length to facilitate mounting in a box if you wish to do this later on, as described in **'What to do Next'.**

(5) Solder in D1 after making sure that you have it the right way around, that is, with the banded end nearest TR1.

(6) Solder in TR1, taking care that it is the correct polarity and using a heatsink clip to prevent damage from overheating. Note that the base of TR1 connects to R2. Be particularly careful when soldering on this board as some of the tracks and pads are very close.

(7) Now IC1 the 555 timer integrated circuit. This may be the first IC you have ever soldered in but don't worry, just follow the steps; insert the IC into the holes on the PCB until the shoulders on the pins prevent it from going further; make sure it is the right way around by noting that pin 1 (the one marked with the small circle indented into the top of the IC) is connected to the negative track on the PCB; then turn the PCB over and carefully solder each of the pins to the pads, making sure that you don't run solder between the pads. See **How to Solder,** for the correct method of soldering an IC. When soldering is complete inspect the connections, making sure that you've soldered them all without shorting any of the pads and that's it. Easy wasn't it?

putting it together ... continued

(8) The 4017 integrated circuit is a CMOS device and therefore very sensitive to static electricity. This is why it is supplied already stuck into special conducting foam which shorts out all the pins and prevents damage from static charges. **Leave it in the foam until you are actually ready to solder it in.** Then, being very careful not to touch the pins, insert the IC into the holes provided making sure you place it the right way around the first time as having to remove it to turn it around increases the risk of damage. Pin 1 (the one marked with the small circle indented into the top of the IC) is connected to LED 6.
The reason we have used such an apparently fragile IC is that it is very efficient and places a very small drain on the battery compared with less sophisticated devices.
Carefully solder the IC in position, soldering pins 8 and 16 in first.

(9) Solder on the press button wires and connect and solder them to the PCB to the pads marked PB1. You are now ready to connect and solder the battery snap wires, taking care to see that you have the correct polarity – red, positive, to the pad marked '+' and black negative to the pad marked '–'.

(10) After checking that all components are correctly inserted and soldered, connect the battery and check that the circuit works by pressing the button. All LEDs should appear to come on dimly; one should come on brightly when you release the button, then slowly die out.

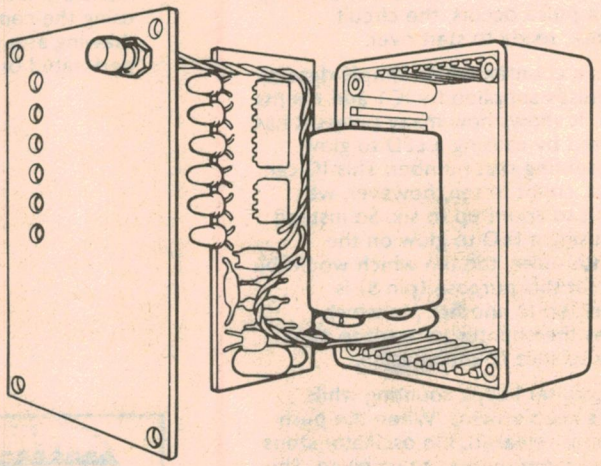


Figure 4: A single LED Dice PCB fits easily into the Zippy box; along with the battery. If you want to add a socket for an external plug-pack adaptor, follow the wiring diagrams given in project one.

what to do next

It is very easy to add a second DICE circuit for games such as Backgammon, Monopoly, etc, where two dice are normally thrown at one time.

Of course, we could simply build a second dice, identical to the first, and press both buttons at one time. But this is inconvenient.

Our method of mounting the second dice avoids the second push button and, indeed, a few other components by 'sharing' some of the functions between the two dice.

Obviously, we cannot share the oscillator components or the counter, as we would simply get a duplicate reading between the two dice. So two individual oscillators and counters are provided, giving two completely random numbers. (Because of the 'tolerance' of components, the two oscillators will run at different speeds, even though we use components of nominally the same value).

To build the dual dice, you will need to build two kits. The first is exactly as per the instructions above (you could use your single dice if you wish). The second is virtually identical – but leave out D1, C2 and C3, as well as the wires to the switch and battery.

Where shown in figure 5, link the two boards with short lengths (about 30mm or so) of hook-up wire. These links should come from the component side of the second board, to the copper track side of the first board. It is fairly easy to solder to the copper pads – just make sure that you don't solder across to another pad and short circuit it.

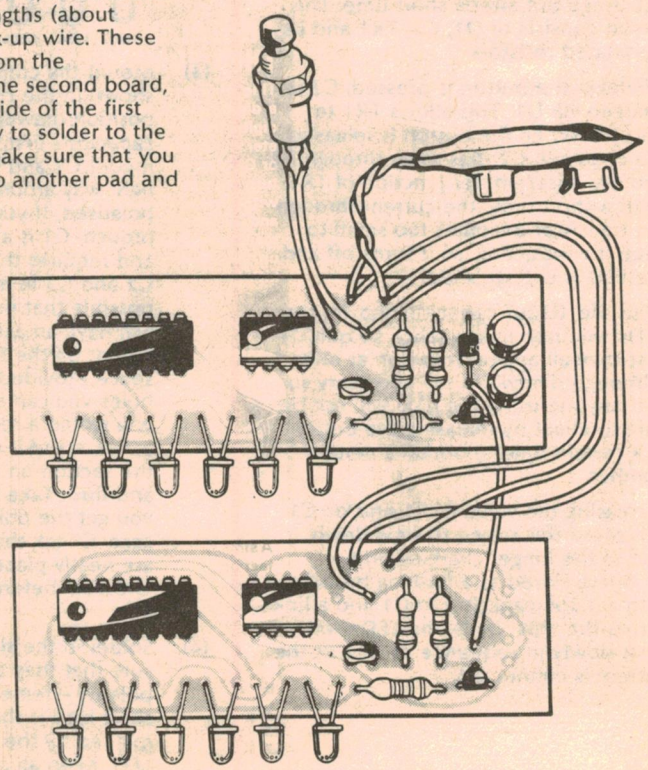


Figure 5: Wire the double LED Dice like this. As you can see, there are a number of components not needed on the second PCB.

DICK SMITH KITS

"look so good your friends won't believe you built them."

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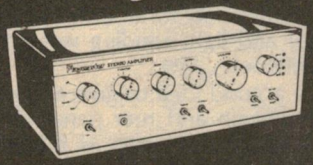

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Cat. K-3515 ..... $165

Note: Transformer is included in above price, but supplied separately at point of purchase.

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STEREO BOOSTER AMP

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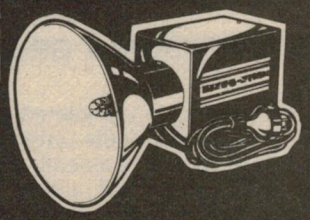

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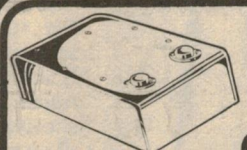

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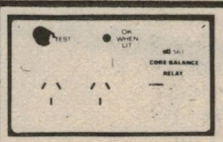

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LYREBIRD

In this final article in the series on the Lyrebird electronic piano, we describe the cabinet assembly and internal wiring details and the tuning and alignment procedures.

by LEO SIMPSON & GREG SWAIN

Now that you have completed all the printed circuit boards of the Lyrebird, the next step is to complete assembly of the cabinet. This is supplied almost completely assembled, together with a Marviplate top panel. The only assembly work required is to attach the solid timber end-pieces and the dummy key pieces which are positioned at each end of the keyboard.

The two solid timber end-pieces are screwed on from inside the cabinet using 25mm countersunk woodscrews. The holes for these screws need to be drilled and countersunk before this task can be done. Position the end-pieces so that they are flush with the front of the cabinet and about 6mm below the bottom surface of the cabinet. The two dummy keys are glued to the front and the ends with the top surface 15mm above the top of the front rail.

We suggest that all the major components should now be temporarily mounted inside the cabinet, their positions marked and all screw holes marked and drilled. Then, when all drilling and other woodwork is complete, all components can be removed and the cabinet stained and finished in a gloss polyester coating such as Estapol. This stage of assembly is quite tedious but the amount of work put in will certainly be reflected in the final appearance.

Fill all surface imperfections in the cabinet with a suitable wood filler which will take stain. Then carefully sand all the cabinet using successively finer grades of abrasive paper. It is best not to use an orbital sander for this task as these machines leave fine spiral scratches which are almost invisible but which are all too obvious once the stain and finishing coats are applied. You will probably have to apply three or more coats of Estapol and light sanding will be required between coats.

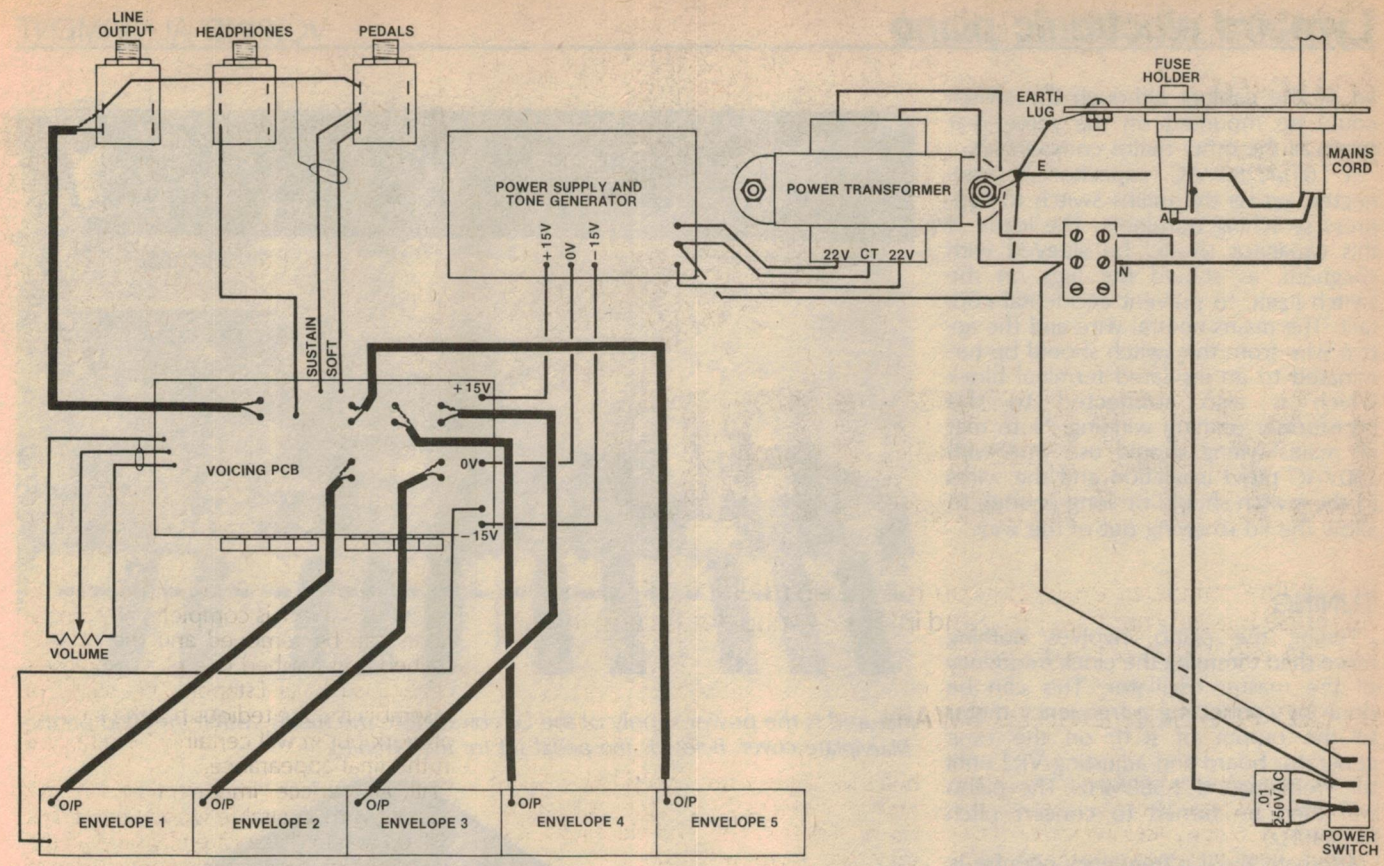
It is also a good idea to give all the interior, underside and rear panel of the cabinet a couple of coats of this gloss polyester to seal the surfaces and prevent them from becoming grubby.

With all this cabinet finishing work finally completed, you can finish the internal assembly and wiring but remember that you will now have to take care not to scratch the exterior of the cabinet.

Mount the two small metal panels on the rear of the cabinet using the PK screws provided and mount the three 6.5mm jack sockets and fuseholder. The transformer and master oscillator board should be positioned as shown in the diagram (and photo). The master oscillator board should be hard up against the rear of the cabinet otherwise the actuators on the keyboard may foul the PC board. This board is held in position by four 19mm x 6BA countersunk bolts with 6mm spacers between the board and base. The transformer is held in position with 12mm x 4BA countersunk nuts and bolts.

To install the keyboard, fit the four butt hinges supplied to the keyboard chassis. Holes for these hinges will have already been drilled according to the diagram of

The Lyrebird is supplied with pedals (not shown here) and an optional chrome stand.



This diagram shows how all the PC boards are wired together. Note particularly the details of the mains wiring.

Fig. 9 in the November 1981 issue. Place the keyboard in the cabinet and carefully align it so that there is a gap of approximately 2mm between the front of the keys and the inside of the front rail and the gaps between the ends of the keyboard and the dummy keys are equal. The hinges are attached to the keybar using 12mm No. 4 woodscrews. (See Fig. 10 of the November issue).

Seventy-three wires should be connected to the master oscillator board and for ease of identification use a different coloured wire for each group of notes. For example, you might use red wire for all the E note outputs from IC9 on the master oscillator board. This would mean that all connections to outputs 12, 24, 36, 48, 60 and 72 would be red. Each wire should be long enough to reach the envelope board furthest from the tone generator board, ie, envelope board one. You will end up with 12 groups of six or seven same-coloured wires.

INTERWIRING

The majority of the wiring within the cabinet consists of the connections between the tone generator PC board and envelope circuits. The tone generator board has 73 outputs, one for each note on the keyboard and these are labelled in the diagram on page 47 of the October 1981 issue. Similarly, refer to the diagrams of Figs. 7 and 8 in the November issue to see how the envelope boards are connected.

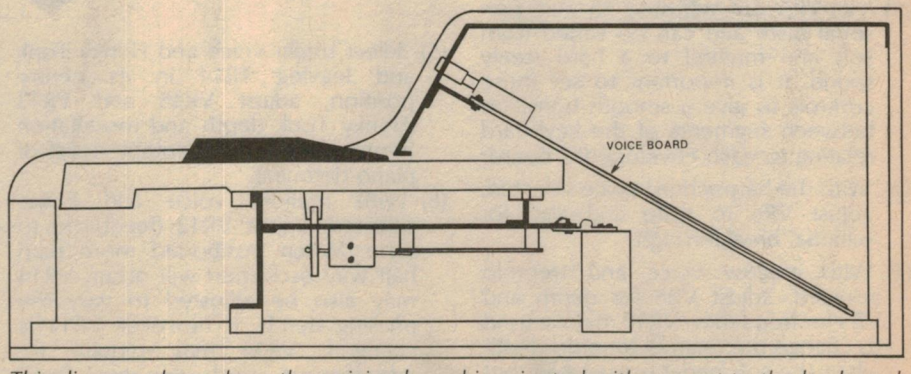
The wiring diagram included with this article shows how all the boards are connected together. Points VT, ED and G on the envelope boards are connected to the corresponding points on the tone generator board (see the diagram for this board in the October issue).

On the keyboard, the busbar closest to the chassis is connected to 0V while the other busbar is connected to the 30V rail. Both of these connections are on the tone generator board.

The five inputs to the Voicing PC board from the envelope boards should be of shielded cable with the shield connected at the voice board end only. The cable to the output socket should have its shield connected at both ends. Two core shielded cable is used to connect the pedal socket and volume control. All wires connecting to the voice board should be long enough to allow the board to be removed to allow the keyboard to be hinged up.

Special note should be taken of the mains wiring details. The mains cordgrip grommet and fuseholder are installed on a separate small panel adjacent to the power transformer. The mains earth wire is terminated to a solder lug which is secured by one of the transformer mounting bolts.

The mains active wire is terminated to the end connection (not the side connection, otherwise a shock hazard is created) of the fuseholder while the side connection runs to the mains switch which has an integral neon lamp and limiting resistor. We installed this switch on the righthand side of the Marviplate



This diagram shows how the voicing board is oriented with respect to the keyboard chassis.

lid of the cabinet although the switch could be mounted on the same rear panel as the other mains components.

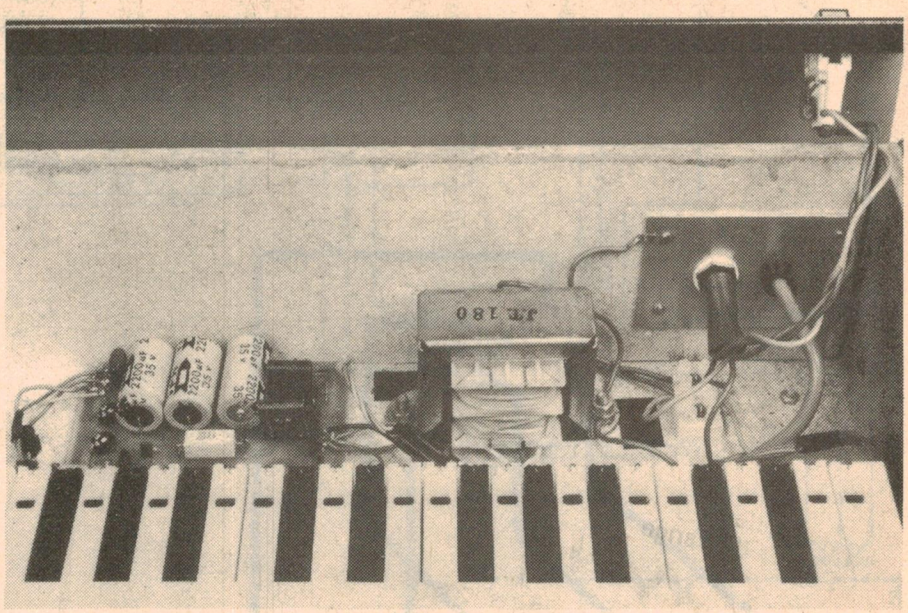
A .01μF/250VAC capacitor is connected across the mains switch to suppress switching transients. The leads of this capacitor should be sleeved with spaghetti, as should the lugs on the switch itself, to prevent accidental contact. The mains neutral wire and the active wire from the switch should be terminated to an insulated terminal block which is also connected to the transformer primary winding. Note that all mains wiring should use wire with 250VAC rated insulation and the wires to the switch should be long enough to allow the lid to swing out of the way.

TUNING

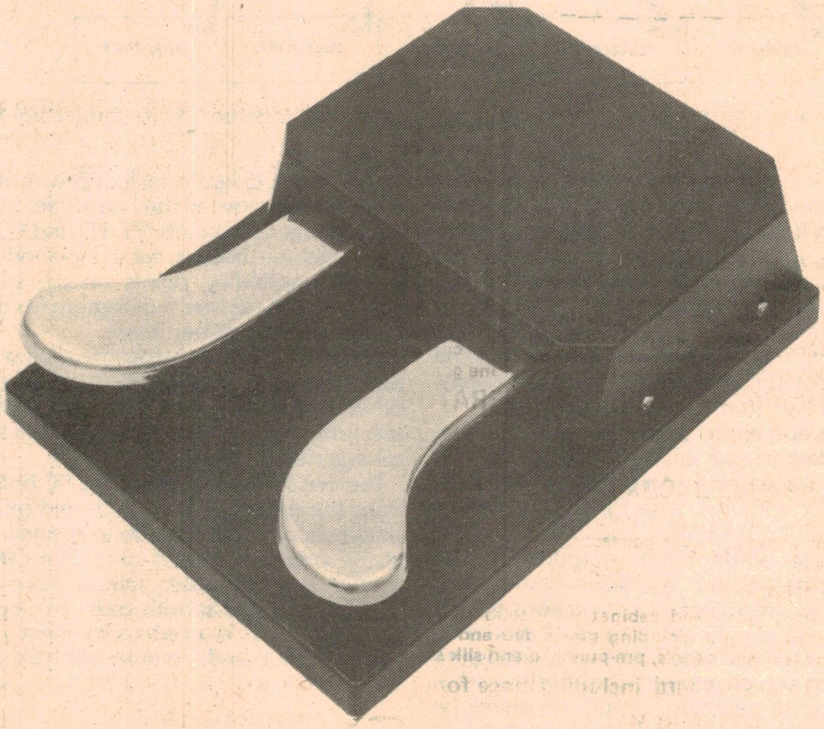
Tuning the piano involves nothing more than trimming the clock frequency of the master oscillator. This can be done by connecting a frequency meter to the output of IC1F on the tone generator board and adjusting VR2 until the frequency is 1.588MHz. The piano will then be turned to concert pitch (A=440Hz).

Alternatively, if a frequency counter is not available then the piano can be tuned to another instrument or by using a tuning fork.

This exact tuning procedure is not absolutely necessary for normal use. Since the outputs of the tone generator are locked to the clock oscillator, the relative tuning is always correct, ie, all notes are correctly tuned relative to one another, even though the overall absolute tuning may be slightly sharp or flat.



Pictured is the power supply of the Lyrebird. Note the mains switch installed on the Marviplate cover. Below is the pedal set for the Lyrebird.



VOICE ALIGNMENT

Start with all trimpots set to the mid position, Effects off, and mellow voice selected.

(1) Measure the voltage at the sustain output, and adjust VR16 to give zero volts when the pedal is not depressed. A positive voltage should appear when the pedal is depressed.

(2) VR1-VR5 are adjusted to suit personal taste and can be varied from soft and muffled to a hard steely sound. It is important to set these controls to give a smooth transition between segments of the keyboard relating to each envelope PC board.

(3) With the harpsichord voice selected, adjust VR6 to taste and also for minimal breakthrough.

(4) With mellow voice and tremolo selected, adjust VR8 for depth and VR9 for frequency. VR10 may be used to change the relative tremolo depth when the soft pedal is operated, but need not normally be adjusted

(5) Select bright voice and Honky Tonk and leaving TR14 in its centre position, adjust VR15 and VR13 (Honky Tonk depth and modulation frequency) to an acceptable level of piano detuning.

(6) With mellow voice and Phase selected, adjust VR12 (feedback) to taste. When positioned more than half way oscillation will occur. VR14 may also be adjusted to vary the phasing depth. If however VR14 is changed, VR15 may require re-adjustment with Honky Tonk selected, since both VR14 and VR15 are operative in this position.

(7) VR11 should be adjusted to give the same output level from the bright voice whether Honky Tonk or Effects off are selected.

Finally, the 1kΩ trimpot on the tone generator board for Early Decay should be set to give a percussive characteristic to the piano, particularly when the Sustain Pedal is depressed.

As all the above settings are subjective, experimentation with different settings should be done to obtain the most satisfactory sound to your liking.

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The Serviceman

Some sets have their own special faults

My two stories this month have very little in common in a technical sense, but were similar in other ways. Both involved two sets of the same model with the same fault. In one case, this helped solve a mystery and, in the other, confirm my original diagnosis.

The first story started with a phone call from a lady who, very obviously, was not one of my regular customers. The first thing she asked was whether I repaired TV sets and I'm afraid I was tempted to reply with one of several sarcastic answers which sprang to mind.

But I resisted the temptation, and just as well as it turned out. It transpired that the lady had received a less than satisfactory deal from a previous serviceman and, understandably, was more than a little suspicious of servicemen in general. A wisecrack from me was the last thing needed at this stage.

In more detail it emerged that her TV set had developed a fault – the exact nature of which remained obscure – and she had called in this servicemen to fix it. In fact, he had made several calls over a period of about five or six weeks, in an effort to find and fix the trouble.

Eventually, he had announced that a certain part – again not specified – needed replacing, but that the exact replacement was not available. He then fitted a substitute, which he claimed should be suitable, and went on his way.

THE BUCK PASSED!

And, strangely, the set did appear to behave itself for about a week. Then it was up to its old tricks again, which was why the lady was now ringing me. As always in such cases, I made a point of asking whether she had contacted the original serviceman and given him a chance to put things right. (We can all get caught with a curly one at times.)

Yes, she had approached him, but his reply was that, since the correct part was not available, there was nothing more that he could do about it. In truth, I imagine, he simply didn't want to be bothered any further with a job that had turned out to be a sticky one, and no longer profitable.

So that was the background and, in these circumstances, I have no qualms about taking over another man's job. While still on the phone I tried to get some idea of the symptoms of the fault, and what make and model of set it was. I drew a complete blank as regards the symptoms, and fared only slightly better as regards the set itself.

All she could tell me was that it was an AWA set, with no hint as to the model. This didn't help much because there have been three series of AWA sets to date: the original British Thorn series, the Australian 4KA series, and the Japanese Mitsubishi K series. So I would just have to wait until I saw it.

When I did come face to face with it, I realised it was one of the last named – the Mitsubishi K series. But the symptoms were not so clear cut. Basically, it involved the horizontal deflection system and, superficially at least, was similar to the old problem of hum in the horizontal system, where everyone does a slow hula dance.

"Mmmmm – what smells so good?" (From Radio Electronics magazine).

But there were subtle differences, a certain amount of jitter for one thing, plus what seemed to be total loss of sync for very brief periods, probably amounting to a few lines. It didn't take me long to decide that this was no job for the lounge room.

Some customers don't take too kindly to their set being taken away, seeing it as an excuse to present an exorbitant account. This customer didn't object directly to the idea, but she did want to know what it was going to cost.

It wasn't an unreasonable question, considering the raw deal she had experienced with the previous serviceman. But just how does one forecast how many hours or what components are going to be needed to cure a tricky fault like this?

I explained how difficult it was but, in the end, I took punt. After all, the set was working and it seemed unlikely that any major components would be involved. The main thing I was risking was man-hours so I set a ceiling figure of $50 beyond which I would not go without further consultation.

BACK AT THE RANCH

Back at the shop, I had another look at the picture. If anything, the symptoms now seemed more obvious, but the likely cause was still obscure. After a little thought I decided that there were three likely areas to be checked: the power supply, the horizontal oscillator, and the sync separator.

I picked on the power supply first, mainly because it was easiest. I was looking for hum, and connected the CRO probe between the main 110V supply rail and a convenient bonding braid between two boards.

The result was an atrocious hum pattern and for a moment I thought I had picked it first time. Then I realised that the amplitude of the hum was such that the set could not possibly work as well as it was if it was really that bad. Eventually, the truth dawned; the bonding braid I had selected as a chassis connection was not really earthy at all and I was looking at random hum pickup.

With that "problem" corrected, the supply rail proved to be above suspicion, with no significant hum level. So where to next? I decided to make it the horizontal oscillator, mainly because I have experienced similar symptoms in other sets due to faults in this section, more specifically involving low value electrolytic capacitors from 1 to 10μF.

Fortunately, there are only two or three capacitors of this type in this part of the circuit and it was a fairly easy job to replace them. Unfortunately, it did nothing for the fault and, for the moment, I mentally cleared that section.

That left the sync separator and, armed with the CRO probe, I began checking appropriate waveforms. The sync separator is on one of the larger boards, PCB-LF, which contains most of the video chain, including the second video amplifier, the sync separator itself, and a following sync amplifier.

Incoming video signals are fed to both the second video amplifier and the base of the sync separator, Q401, a 2SA268. I checked the video signal at this point and found it to be virtually perfect, with cleanly defined horizontal sync pulses.

The same applied at the base of the sync separator, after the signal had passed through a shaping network. But it was a different story at the collector of Q401. What had been a nice rectangular pulse was now triangular, noisy, and somewhat reduced in amplitude.

Well, at least that was something. While the details still had to be determined, it seemed obvious that I had found the fault in general terms. My next step was to make some voltage checks around the transistor but this revealed nothing untoward and seemed to rule out an obvious failure in either the transistor or its associated components.

Nevertheless, I checked out as many individual components as possible, either by measurement or substitution. When all these checks proved negative, I was left with only the transistor, in spite of its static behaviour in the circuit.

In theory, the easiest thing to do was replace it, but this presented problems. I did not have the type in stock and it appeared that there was a temporary shortage of them. So, rather than wait for fresh stocks, I decided to find a suitable substitute.

My list of equivalent types suggested that the Philips-Mullard type BC327 should suit. Unfortunately, this was a complete failure – there was now no sync of any kind, either line or frame. However, it was possible to juggle the appropriate controls to produce a stationary picture, and I was surprised to find that all signs of pulling had now vanished.

Suspecting that I had either fitted the transistor incorrectly, or fitted a faulty one, I pulled it out and checked both possibilities, but both were ruled out. So I decided to try another alternative type, a BC159, but this produced exactly the same results as the BC327.

By now it was fairly obvious that the sync separator circuit was quite critical and that only a 2SA628 would do. So I tried a new approach; find a 2SA628 in another part of the circuit and swap it for the suspect one in the sync separator. This should not only restore the sync separator circuit, but provide another check for the suspect 2SA628.

In fact, the circuit showed several 2SA628s in the set, one being the horizontal oscillator. The only snag was that it turned out not to be a 2SA628, but a BC327. Suddenly I realised what my predecessor had done. Suspecting the horizontal oscillator, and not having a 2SA628, he had fitted the "substitute part" – a BC327.

The next source for a 2SA628 was in the vertical deflection circuit (Q433) and this was duly swapped with the suspect transistor in the sync separator circuit. To my surprise, the picture came up perfectly and locked in both the horizontal and vertical modes.

Well, there seemed little doubt now that the original Q401 transistor was faulty, but what surprised me was that it seemed to be working satisfactorily in the vertical circuit. In fact, I was cheering a little too soon. While the vertical circuit would lock, it was extremely critical; far too critical to give to the customer.

So how would a BC327 function in this position? It didn't take long to make the change and, would you believe, it worked perfectly. I must admit I was a little sceptical, but I ran the set on the bench for several days and it didn't miss a beat.

FOLLOWING UP

In fact, I have checked back a couple of times since returning the set to the customer and it hasn't faltered. As for my account, I was able to keep this well within the ceiling figure I had quoted, so the customer was delighted on all counts. I have no doubt I will get all her custom from now on.

Within days of returning the set, I had another identical model on the bench, with the identical fault. The only difference was that the symptoms were slightly less obvious.

Fresh from the previous set, it took me only a few minutes to confirm that I had the same degradation of sync pulses at the Q401 collector. But, while I was fairly certain what would have to be done eventually, I took the opportunity to try a BC327 replacement once again, just to confirm the situation. As expected, the result was exactly the same; it simply would not work.

So I pinched the 2SA628 from the vertical deflection circuit again, replaced it with the BC327, and fitted the 2SA628 in the sync separator. The set worked perfectly. And, since the whole exercise took me only a few minutes, any time I had wasted on the first set was more than repaid.

My next story concerns a National model TC86A or, more correctly, three of them. In the case of the first set, the owner complained that the picture brightness was varying and, as I deduced from his description, was displaying horizontal retrace lines during periods of extreme brightness.

When I finally called on the customer, I was able to fill in a few more details. It appeared that the brightness level changed as the set warmed up, starting off with such excessive brightness, together with retrace lines, that it could not be controlled by the brightness control.

After the set had been running for 15 or 20 minutes the brightness would gradually decrease, to the point where the brightness control could set it to an acceptable level. But then, if the set was switched off, and allowed to cool, it would come up with excessive brightness again when next switched on.

Unfortunately, the set was in operation when I arrived, so I could not see it at its worst, but I did observe some drop in brightness while I was there. Again, this was no job for the customer's lounge room; I would need to have it on the bench, probably for several days, to tackle a fault of this nature.

WORSE THAN I THOUGHT

When I switched it on in the workshop, the result was worse than I had imagined from the customer's description. The brightness was really excessive, retrace lines were very obvious, and the picture was flaring badly. All in all, it was thoroughly objectionable.

I had already removed the back, so I went immediately to the sub-brightness control (R306) and found I was able to reset this to produce a perfectly normal picture. The only snag was that, after about half an hour, the picture was so dark as to be virtually unwatchable, even with the main brightness control advanced to maximum.

Checking the collector voltages on the red, green, and blue output transistors (TR351,352,353) confirmed that they were excessively high, virtually cutting off the picture tube. This was no more than I expected, but the question was, where did I go from here?

The video chain is a long one. From the three output transistors just mentioned (sub-board TNP65929, on the neck of the tube) the circuit moves back to three driver transistors (TR901, 902 and 903 on board TNP65323), thence to three amplifier transistors (TR606, 607 and 608 on TNP65427), through various decoding networks and ultimately to the second video amplifier (TR301), the sub-brightness control, and the video process IC (IC151) on TNP65113.

It is not so much the length of this chain that is important, but rather the fact that it is direct coupled throughout; from the picture tube cathodes right back to the video process IC. So where does one begin to look for a DC drift in a set-up like that? To classify the task as formidible is to put it mildly.

At this point I should mention that I now had a second set of this model in the workshop; a set belonging to a local motel, and which had developed an audio fault. I had found and fixed this fault, but was holding the set for a few days. It was only a spare, the motel was in no hurry for its return, and I had decided to keep an eye on it to make sure my diagnosis had been correct.

So why not take advantage of the situation and try a spot of board swapping? I reasoned that if I could narrow the fault down to a particular board it should be relatively easy to pinpoint the individual component.

For a start I picked on board TNP65427. I swapped them over, allowed both sets to cool down completely, then switched them both on together. Result: no difference to either set. Brightness was normal on the set with the audio fault, and still grossly excessive on the other set.

Next I selected the board with the video process IC, second video amp, and sub-brightness control, TNP65113, and went through the whole ritual again. And this is where my "brilliant" reasoning came unstuck. The swap seemed to largely cure the fault in the original set, but not completely, and this latter point was puzzling in itself. But the real puzzle was that the video fault was not transferred to the other set.

Thoroughly confused, I swapped the boards back to their original sets and suddenly the video fault was back to where it had started, though I seemed to sense that it was not quite as bad as it had been originally.

In desperation I swapped the boards yet again. This seemed to cure the fault without creating any problems in the spare set with the audio fault. And that's how I left the situation for the next couple of weeks, running both sets all day and every day.

But at the end of that time I had to make a decision. Should I take the easy way out and leave the boards swapped? While I might not normally have done so, I decided to take a punt on this occasion. The real risk was to the set with the audio fault and the possibility that I might have transferred an intermittent video fault to it. On the other hand, the risk seemed small, and I was in a position to keep it under close surveillance, so I went ahead.

I intended to keep a close watch on the other set also. Even though it seemed to be cured, the fact that I had not found the precise cause had me worried. In addition, I suspected that the picture tube was slightly gassy, and that this might be contributing to the symptoms.

I explained all these points to the owner and, in spite of the time I had spent on the set, I made only a nominal charge. He, in turn, accepted my explanation quite readily and indicated that he was quite happy to have a new tube fitted if, and when, the worst happened.

So that was how we left it.

A MYSTERY SOLVED

And the mystery might have remained just that had it not been for a third National TC-86A, which landed in the workshop a couple of weeks later. The symptoms were similar, but not identical. In this case the picture tube was cut off permanently, with no suggestion of heat sensitivity, but I was able to restore a normal picture by adjusting the sub-brightness control as before.

I let it run like that for several days, and it seemed reasonably stable, but, once again, I had a vague impression that there were minor brightness changes from time to time. In any case, simply curing a fault like this by adjusting the sub-brightness control was no real solution; why had the brightness shifted in the first place?

At this point, I decided to ask for help. I rang the service manager at National and put the problem to him, hoping that they may have already encountered the problem. With the benefit of hindsight, it was something I should have done a lot sooner.

As far as they were concerned it was a relatively common problem. Most of these sets are now between six and seven years old and the problem involves the edge connectors for the boards, which no longer provide reliable low resistance contacts. He went on to say that the trouble could usually be overcome by a thorough cleaning of all the contacts, but added that this may not be successful in all cases.

If it wasn't, the only answer was to remove the whole contact strip and fit a new one; quite a substantial job involving a large de-soldering operation. He also pointed out that the most critical set of contacts were those associated with board TNP65113, at the beginning of the video chain. A small change in voltage here, due to contact resistance, would be quite significant by the time it reached the picture tube cathodes.

— Continued on p.126

If you have a factual and interesting story to tell about electronic servicing, write it in your own words and send it to "The Serviceman", c/- "Electronics Australia", Box 163, Chippendale 2008. If the Serviceman uses it in his column, we will pay an appropriate fee.

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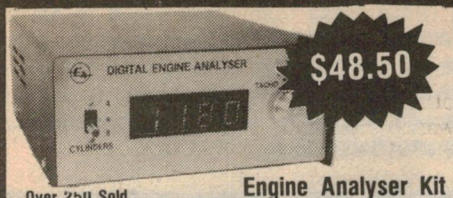

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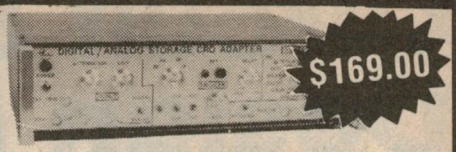

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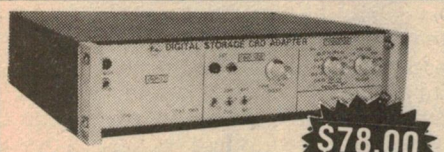

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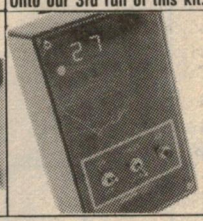

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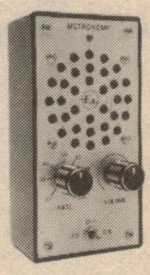

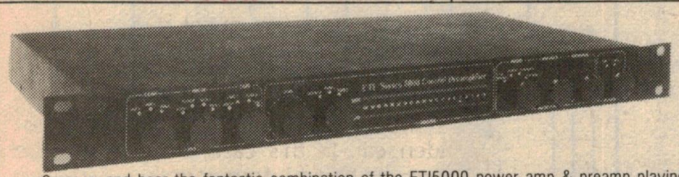

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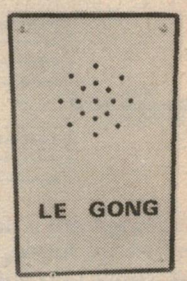

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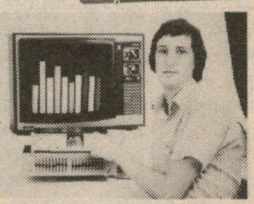

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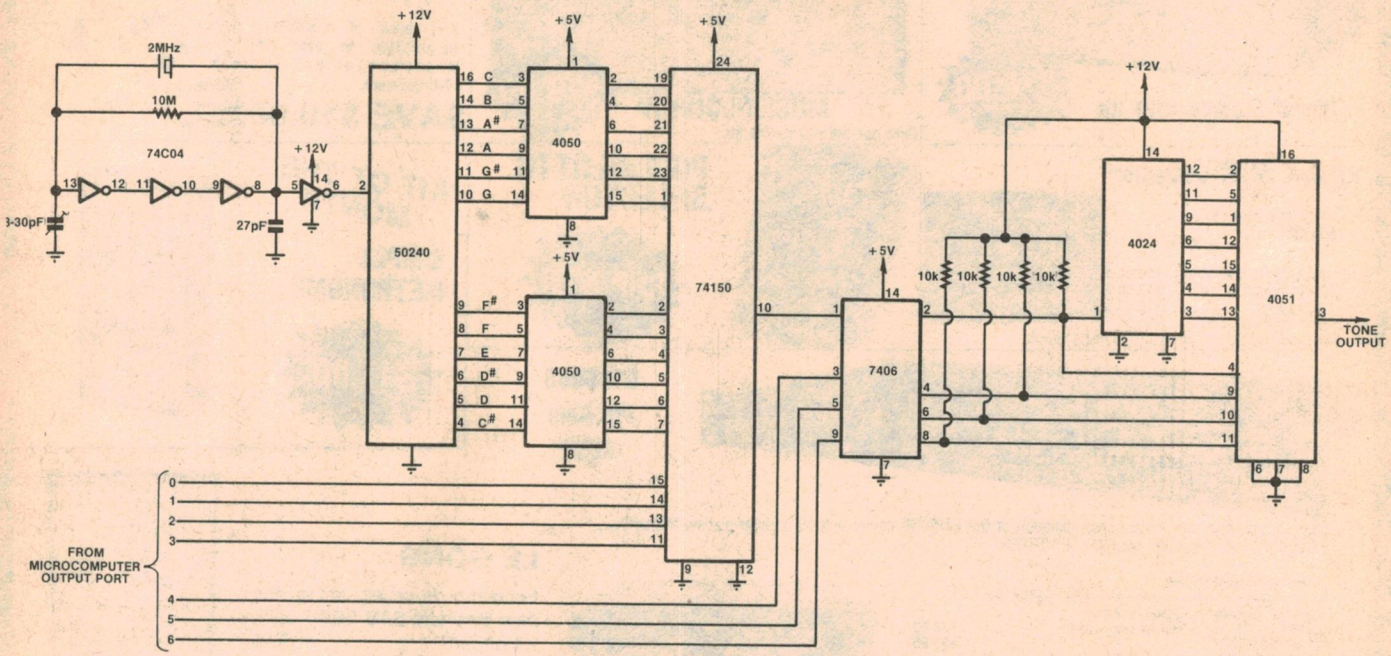
Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Musical Tone Generator Peripheral



Evolving from a design for a low cost, twelve-tone, four-octave noise generator (that could be computer controlled by means of a single parallel output port) which appeared in "Popular Electronics", April 1978 under the heading "Build a Computer Music Box Peripheral", this new design covers eight octaves without the necessity for separate trimpots to "tune" each individual note (as required with the original design). Development was assisted by the EA "Musical Tone Generator" article of July, 1980 and also information in Forest M. Mims' "Engineer's Notebook" published by Radio Shack.

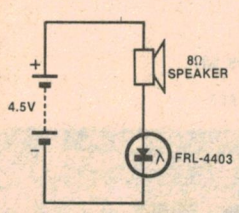
The circuit operates from a 2MHz clock signal, which is generated by a simple crystal oscillator, designed around three CMOS inverters of a 74CO4. The fourth inverter squares and buffers the oscillator output. A 50240 "top-octave synthesizer" is driven by the clock signal and divides the input to produce outputs very closely approximating (in frequency ratio) those laid down for the equal tempered scale. The output signals are fed to two 4050 hex buffers, and thence to a 74150, 1-of-16 data selector.

Logic signals, which may be conveniently provided by four bits from a microcomputer output port, are applied to pins 15, 14, 13 and 11 to select the particular frequency, which is then fed to one channel of a 7406 hex open-collector inverting buffer. The 7406 provides the necessary buffer function between TTL and CMOS devices. From the output of this buffer the selected frequency is taken to the clock input of a 4024 7-stage CMOS binary counter/divider. This provides the lower octaves by means of output pins 1, 2, 5, 12, 13, 14 and 15. These signals are then applied to a 4051 analog multiplexer.

Three of the other buffers in the 7406 are also fed from the output port of the microcomputer, with the buffer outputs then being applied to the A, B, C inputs (pins 9, 10 and 11) of the 4051. Thus, both octave and note selection is under the control of the microcomputer, with the selected tone appearing at pin 3 of the 4051.

R. M. Wild,
Eastwood, NSW.

Simple Audible Flasher



By connecting a small loudspeaker in series with a "flashing" LED, a "ticking" will be heard every time the LED circuit is energised.

J. Rogers,
Glenelg, SA.

"Patch" for Dream 6800 Kaleidoscope Program

With just a slight modification a further set of interesting patterns may be obtained from the sample Kaleidoscope program published in the July, 1979 issue of EA. Details are as follows:

Change:

0218	33DF
0222	22EO

Add:

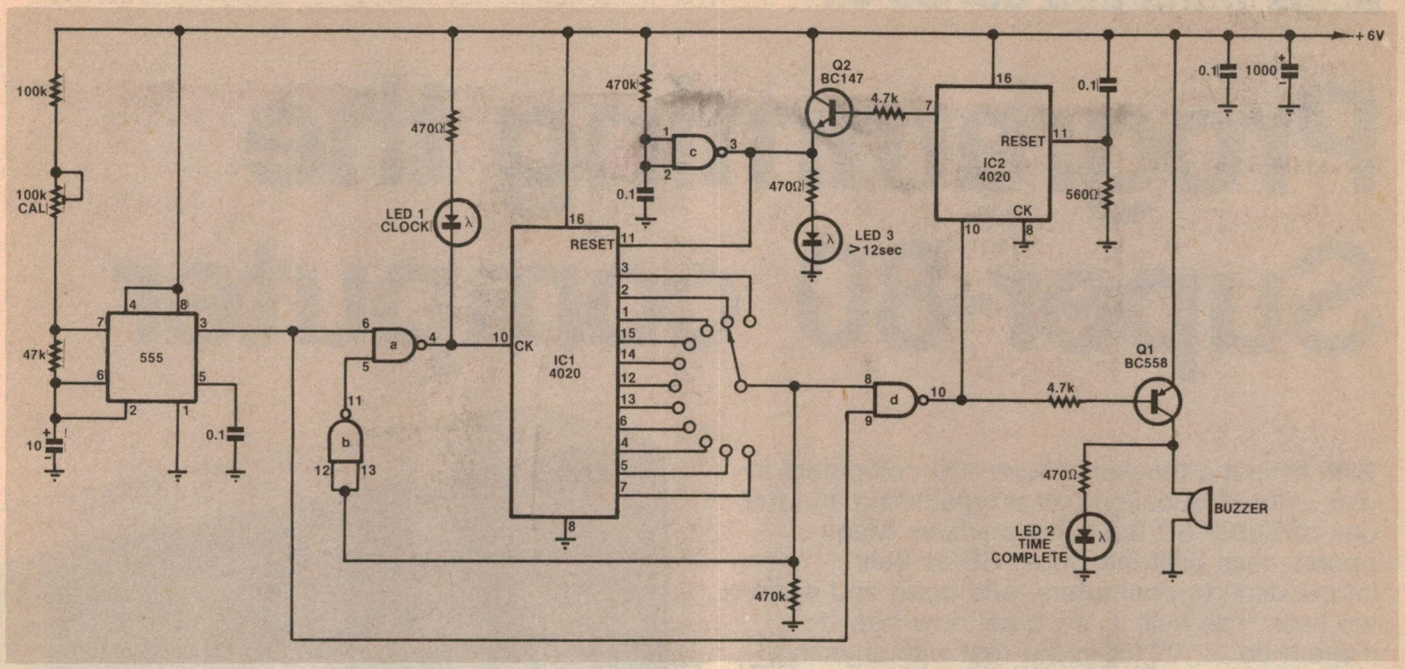
02EO	FO65
02E2	65OF
02E4	E5A1
02E6	22EA
02E8	00EE
02EA	F5OA
02EC	35OC
02EE	12EA
02FO	00EE

When the program display is operating, the image may be frozen at any time by pushing key "F". To restart push key "C".

Note that the 0218 instruction change limits the manual input to keep from corrupting the patch.

J.L. Elkhorne,
Chigwell, Tas.

Modifications to the Utility Timer



Addition of two extra ICs and several other components adds to the versatility of the Utility Timer described in the August, 1978 issue of Electronics Australia. The modifications provide for automatic switch-off of audible alarm after a preset time, and three LEDs to indicate (a) circuit "counting", (b), end of the selected timed period, and (c) that the end of both the selected and alarm time periods has taken place.

The first LED is connected between the supply and the "clock" input of the original 4020, with a series 470Ω resistor to limit current flow. This indicates the presence of clock pulses at this point.

Via another current-limiting resistor, the second LED is connected in parallel with the buzzer to provide visual as well as audio alarm.

Pins 8 and 9 of the 4011(d) are separated with pin 9 being left connected as in the original circuit. Pin 8 is connected back to pin 3 of the 555. This modification was fully described in the December, 1980 issue of this magazine, and provides a pulsating sound from the buzzer. It will be noted that when the preset time has elapsed, the output of 4011(d) consists of a string of pulses at the nominal frequency of the 555, eg, approx 0.6Hz.

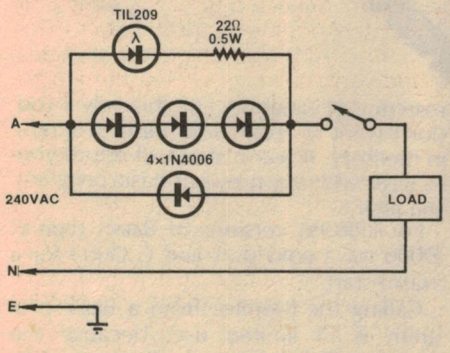
A second 4020 14-stage binary counter is added to the circuit, with its clock input being fed from the output of 4011 (d). Thus when the selected period elapses, the second 4020 is clocked by the pulses from 4011(d).

When the selected counter output (pin 7) goes high, the BC147 (Q2) is switched on, energising the third LED and resetting the first 4020, which is held in a state of permanent reset – until the timer is switched off (and another cycle started). Thus the BC558 is de-energised which stops the buzzer and extinguishes the second LED.

Note that by selecting another output of the second 4020, other durations of alarm period can be preset according to the user's requirements. Note also that the second 4020 is reset by the network comprising the 0.1μF capacitor and 560Ω resistor. Reset occurs at switch on, ie every time the timer is activated.

K. Hamilton,
Reservoir, VIC.

LED Indicator for Remote AC Loads



Four low-cost rectifier diodes, one resistor and a LED are all that is required to construct a simple indicator of current flow in AC loads. Although intended for mains operated equipment, the idea could easily be adapted to lower voltage applications, provided due allowance is made for the nominal 1.5 volts drop incurred by the insertion of this network.

The idea should function equally well in DC circuits, but remember to observe the normal polarity conventions. When used in DC circuits, the single diode, reverse connected across the series string of three diodes, may be omitted.

Using the specified diodes the circuit is suitable for loads up to 100 watts. For increased loading use larger diodes, and perhaps increase the value of the 22Ω series LED resistor.

From "Wireless World",
May, 1981.

Hum Measurements

This idea presents a simple method for the investigation of hum fields emanating from mains operated equipment.

A telephone pick-up coil is sensitive to 50Hz radiation and if fed into a amplifier and loudspeaker or headphones will allow a qualitative evaluation of the strength of a hum field.

If it is desired to make quantitive measurements of relative field strengths, a suitable AC voltmeter could be coupled to the amplifier output. And for investigating very weak signals, a 50Hz (or frequency as desired) "acceptor" filter could be included in the amplifier chain to obtain much improved resolution.

With the aid of any one of these setups comparisons between transformers can be made, as well as the effectiveness of magnetic shields and the location of critical components in equipment.

P. Dimond,
North Lidcombe, NSW.

PSST! Got any neat circuit ideas? Why not send 'em to us? We pay between $5 and $20 per item, depending on how much work we have to do to publish it.

Some hints and advice on

Programming the Super-80 computer

With almost a thousand Super-80 computers in use, a lot of questions on programming and the use of Super-80 Basic have arisen. Many people have built the Super-80 as their introduction to computers, and again and again we hear "I've built it, it works, now how do I make it do . . .?" (fill in the rest with anything from keeping inventories to playing space games to running a greehouse). While "hands-on" experience is the only real teacher, here are some tips and hints.

by PETER VERNON

First of all, users should know that there are two versions of the Basic Interpreter available on tape. Some slight bugs in V1.2A have been corrected, and all cassettes now sold carry the V1.2B version. If you have V1.2A, see your local Dick Smith store for an up-dated version.

EPROM Basic is slightly different again. Obviously it has been modified to run in a different address space, and some functions have not been included. In particular we have seen an EPROM-based interpreter which does not include the "MON" function for calling the Monitor routines from Basic. In any case, "MON" is a command, not a statement. This means that it cannot be used from in a program, but only as an immediately executed function, putting the machine into the Monitor mode.

Using the Monitor functions

For those who require the use of Monitor functions from Basic, the "USR" statement is the one to go for. The Monitor routines are in ROM beginning from address C000. In decimal, this is 49152. A program statement "USR(49152)" will cause the computer to exit Basic and enter the Monitor. The screen will clear the Monitor heading will be displayed and the Monitor prompt, a full stop, will replace the asterisk used by Basic. At this point Monitor commands can be entered and executed.

More usefully, the statement "USR(49156)" will enter the Monitor at the "Warm Start" point, without re-initialising the system. The Monitor prompt will be displayed, but the screen display will be otherwise unaltered.

To return to Basic from the Monitor, use the "G" command. For tape-based Basic, type G 0100 for a "Cold start" and G 0103 for "Warm". The difference is that a Cold start initialises the system, clearing the Basic program area and resetting all variables. Use this only if you don't want to retain your Basic program in memory. A warm start will return you to Basic with any previous basic program still intact.

For EPROM versions of Basic, type G D000 for a cold start and G D003 for a warm start.

Calling the Monitor from a Basic program is of limited use, because the system will not return to Basic to complete the program. More useful is to be able to call particular routines from the Monitor. The "Monitor Handbook" gives the start address of the most useful Monitor routines. These must be converted to decimal before use in the "USR" statement.

For instance, USR(49159) will call the

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editor routine of the Monitor, which may then be used as described in the Monitor Handbook. Pressing "return" will return you to Basic. Other Monitor routines can be used in the same way.

On a different, but related point: the Monitor contains routines for turning the motor of a cassette recorder on and off, as used by the "T" and "Z" Monitor commands. These routines simply load an appropriate byte into the 6-bit latch to control the motor relay and VDU enable circuitry. Setting bit 1 in the latch to "0" will turn the relay on, and a 1 bit will turn it off. This latch is at an I/O address of F0, or 240 in decimal.

To turn the cassette motor on from Basic, type OUT 240,253. To turn the motor off again use OUT 240,255.

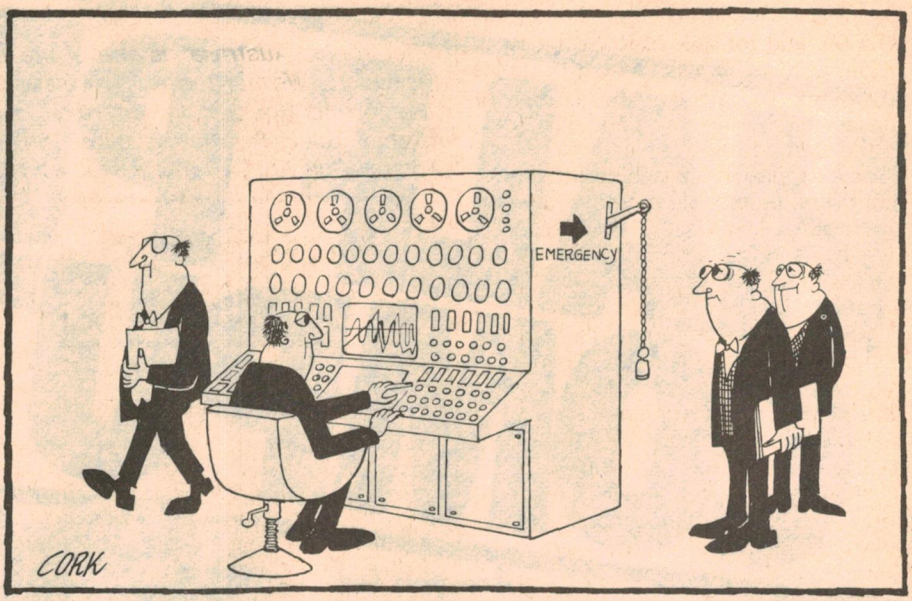
If these decimal numbers were translated to binary, it would be seen that the only difference between them is in Bit 1. Bit 2, which controls the VDU status, is not affected, so the display screen will remain on. If you wanted to turn the display off to allow the processor to run at full speed, type OUT 240,251. To turn the display on again the command is OUT 240,255. Remember to press "return" after entering each command.

Some Monitor routines require some information before they can be used. For instance, the CASOUT routine which saves an area of memory on tape requires that the HL register pair has the address of the first byte to be saved and the DE register pair has the count of the total number of bytes. These are registers inside the Z80 microprocessor, and they may be manipulated by Z80 machine code instructions.

Referring to a book such as "Programming the Z80" by Rodney Zaks will show that there is an instruction with the nmemonic" "LD dd nn", where dd stands for a particular register pair and nn represents two bytes of data. The actual object code varies according to which register is to be loaded. For instance, the instruction "LD HL, nn" is 21 yy xx, where yy is the low byte of a two-byte word and xx is the high byte. The high byte will be loaded into register H and the low byte into register L. The Z80, in common with many other 8-bit microprocessors, stores 16-bit values with the low byte first in memory, followed by the high byte.

In the same way, the instruction LD DE, yy xx is 11 yy xx, and LD BC is 01 yy xx. These are examples of the immediate addressing mode, where the bytes following the operation code is used directly as data. Note that all op codes are given in hex

That's all very well, but how are these operation codes used? Quite simply, really. In the Monitor mode, enter "E 0000". An address will appear, followed by a byte of data. To replace this data with what you want, type "21" and press return. The next address/data combination will be displayed. Enter the low byte which you wish to load into the L register and press return. Similarly enter the high byte in the next memory location.



To terminate your machine language program, enter "C9". This is the operation code for a RETurn instruction, which instructs the computer to jump back to the program it left to perform you routine. To leave the Enter mode of the monitor, type a full stop in the next memory location and press return. The Monitor prompt will reappear. Type G D003 to return to Basic (assuming you are using the EPROM version).

Now, when you type "USR(0)" the machine code program at location 0000 will be executed. The byte at location 0001 will be loaded into the L register, and the next byte will be loaded into the H register. The "C9" instruction will cause the computer to return to Basic after executing the program.

Alternatively, the machine code program can be performed in the Monitor mode by typing G 0000. In this case the RETurn instruction will make the processor return to the Monitor at the completion of the program. Other registers can be loaded by using the appropriate op code in place of 21.

One point to remember is that in the Zilog nmemonics the destination of the data comes first, then the source. For example, LD HL, nn means Load INTO HL the data represented by nn. The instruction LD (nn), HL means load the address nn with the contents of HL. (The parentheses indicate that this is an instruction in the absolute mode, with the two bytes following the op code representing a address which will be loaded, rather than direct data).

Display speed

Super-80 Basic is well equipped with commands for entering and correcting programs. The normal LIST command can be used in the form LIST xxxx which will list line number xxxx on the display, or LIST xxxx, which lists from xxxx to the end of the programk or list LIST, xxxx which lists from the start of the program to line xxxx, or LIST xxxx, yyyy which lists from line xxxx to line yyyy. Listing can be stopped by pressing the BREAK key, or temporarily halted by pressing and holding the space bar. Releasing the space bar will continue the listing.

In addition there is the EDIT command, for correcting errors in single lines.

The problem with the LIST command is that the listing is so fast that a long program scrolls off the screen before it can be read, or even before the BREAK key can be pressed. Programs can be listed a section at a time by use of the space bar, and there is no problem when you know the line numbers of the section you want to list, but for checking a long program, or a series of DATA statements, a slower but continuous listing might be desirable. This is easy to achieve.

The speed of the Super-80 display is controlled by a value stored in the Monitor stack area. It is this value which is changed by the Monitor "V" command, but it can be tedious to enter the Monitor, change the V value and re-enter Basic just to slow down the display a little. A simpler method is to use the Basic POKE command.

As shown in the Monitor Handbook, the display speed value is stored at a location five bytes down from the top of

the stack. In a 16K machine, the stack begins at location 3C00. For 32K the start is 7C00, and for 48K of RAM the stack begins at BC00. In each case it occupies 512 bytes. To calculate the address of the last byte of the stack, add 01FF (hex) to the start address.

For example, in a machine fitted with 48K of programmable memory, the end of the stack is at BC00 + 01FF, or BDFF. Five bytes down from the top of the stack is BDFB, which in decimal is 48635. To alter the speed of the display, use a POKE 48635, S statement, where S is a number between 0 and 255 decimal. A value of 10 for S gives a display speed suitable for listing program lines at a readible speed. S equal to 255 gives a display which is tediously slow.

When the display speed is slowed down, the keyboard input routine is also affected. Because of the way the Super-80 is designed, entry of each new character causes the previously entered characters to disppear from the screen while the input buffer is updated. They are then re-displayed, with the new character added. No keyboard entry will be accepted until the flashing cursor re-appears on the screen.

The speed of a program display can be varied from within a program by a simple subroutine such as the following:

```
999 END
1000 POKE 48635,10: REM SLOWS
DISPLAY
1010 PRINT "THIS IS AN EXAMPLE OF A
SLOW DISPLAY"
1030 POKE 48635,0: REM RESTORES
NORMAL SPEED
1020 RETURN
```

A GOSUB 1000 statement in your main program will produce the slower display. The END statement before the subroutine prevents the computer inadvertently executing the subroutine when it completes the main program. This would produce a "U ERROR" (Return without Gosub).

Location of the display speed value for machines with 16K or 32K of memory can be calculated in the same way as for 48K. For 16K the decimal location is 15867, and for 32K the location is 32251.

Another subroutine could be written which allows different areas of memory to be displayed on the screen. Output port F1 (hex), or 241 decimal holds the upper seven bits of the screen address. Sending a different value to this port will display a new area of memory.

That's it then. Try out these procedures on your own system, and try any variations that occur to you. Just remember who's boss. You can't damage the computer by misprogramming it, although you will get some very peculiar results! As a last resort you can always press the Reset button.

50 & 25 YEARS AGO

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

January 1932

Superheterodyne boom:

We are about to start a new radio season, and from every indication it seems certain that this season is going to be a "super-heterodyne" boom. The passing of the cheap "two," with its lack of selectivity, is imminent, and we feel certain that with the opening up of a few more stations the better class sets will come into their own. Enthusiasts who want to obtain interstate reception will be forced to adopt the only truly selective circuit, the superhet.

Many readers may be sceptical about supers, but we want to say here and now that the old supers were not the same as the new ones. Personally we have just completed the eleventh modern super. These have been built during the past three months, and each one has been better then the last. To go back to building and getting enthusiastic about three and four-valve sets is going to be our hardest task in the future. We assure all enthusiastic experimenters that once they get on to superhets their enthusiasm is going to take a new lease of life. In the first place, the natural selectivity of the superhet is astounding. Interference troubles are immediately a thing of the past. Sensitivity can be obtained without any tendency to oscillation, and there are definitely no snags. The coil kit specified has now been used by us in building four superhets, and in each case the adjustment of the trimmers has been accomplished in less than 10 minutes, and then one setting was perfectly OK for every setting of the dial. Two spot tuning, image interference, and all other troubles we often read about in books have entirely failed to materialise, and in every way the superhet can now be considered an entirely satisfactory and serviceable job, easy to build, simple to adjust, and capable of giving excellent results.

From time to time we have also heard tales about the tonal quality of superhets being poor on account of side band cutting or some such theory. In actual practice this is absolute piffle, and if anyone can fault the tonal quality of any of the supers described in this issue he must be extremely hard to please.

January 1957

World's largest PA system:

At the final gathering of the German Evangelic Church Congress late last year in Frankfurt, a Philips loudspeaker system was used to cover a congregation of 300,000.

For this purpose, at the Rebstock Airport a huge 100ft cross was erected in which the vertical pole served as an enormous sound column. Two hundred and fifty speakers were beamed over an area of 32,000 square metres with a power of 2000 watts. The vertical pole was a triple speaker column radiating the sound in three directons and distributing speech and music to people listening up to half a mile away.

When the congregation was dispersing full power was used for police instructions and paging purposes and every word spoken could be clearly understood in the streets of the city several miles away.

For the facilities required 14 microphones were used. In addition to the various speakers, it was necessary to reinforce the voices of 5000 singers and 2000 trumpeters. Six 750 watt amplifiers were used to feed the sound columns.

☆ ☆ ☆

Guesswork on the way out:

One feature of car service today is the growing use of electronic service aids; gadgets which take the hit-and-miss out of car tuning and maintenance, replacing trial-and-error fix-it methods with instrument readings which eliminate doubt and pinpoint troubles in seconds instead of expensive hours.

There are machines today which, electronically, can pick faults in a worn distributor; detect wrong jets in a carburettor; wrong timing; faulty batteries, and a string of other trouble-makers as long as one's arm. And, having pinpointed troubles in the fuel and ignition departments, there isn't much left for a mechanic to diagnose.

A new generation of mechanics is arising, which relies just as much on meter readings as their counterparts in the radio industry.

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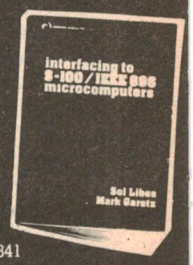

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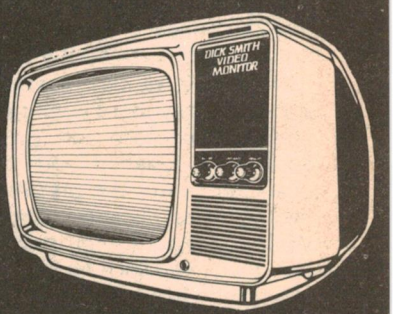

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For the professional user — or even the hobbyist who uses his system for long periods, a Green Screen Monitor is a must.
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A brand new model — now with extra value! Comes with 16K RAM plus provision for extra 16K (making 48K total) and it's $100 cheaper than the previous model! (RS232 interface and S-100 card optional at extra cost). Now you can have a full 48K computer for $299 less than before!!!

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DSE A123RB

We test a powerful new 6809 system

Sphere computer for business and hobby use

Recently we put the Sphere microcomputer through its paces. Sphere is a new product by a Sydney company, and is based on the 6809 microprocessor with the SS-50 bus. In addition to solid packaging and a great capacity for expansion, the Sphere offers a powerful, moderately priced computer system for hobbyists, small businesses and software developers.

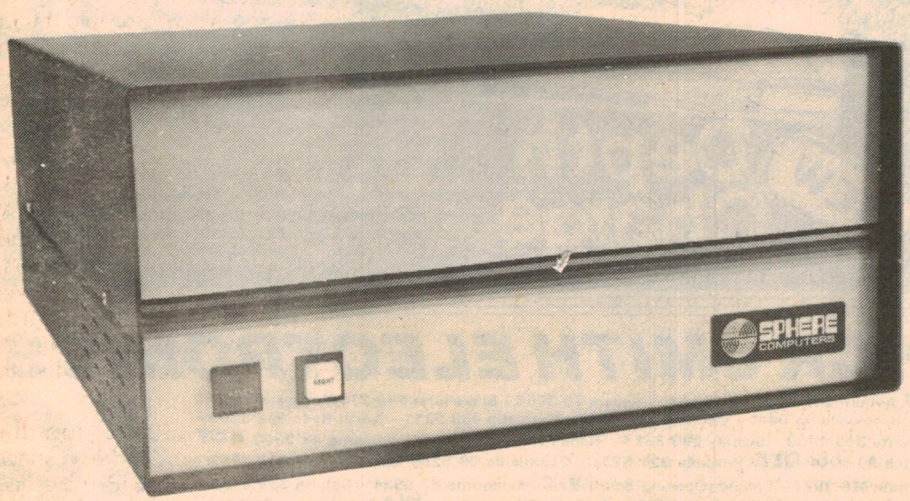
by PETER VERNON

Physically, the Sphere is impressive. It is housed in a rugged aluminium cabinet 400mm wide x 182mm high x 512mm deep, with the top, sides and base anodised blue. The front panel is bare except for two illuminated pushbuttons, the Sphere logo and a narrow decal of orange and black stripes. At the rear is a power switch, fuse holder, mains cord entry point and the cooling fan. As a first production model our machine was marred by a rather noisy fan but we have been told that a new, quieter fan will be used for subsequent production.

The rear panel is partly composed of eight individual strips held in place by self-tapping screws. These panels can be removed and replaced with similar strips incorporating cut-outs for connectors to peripheral equipment. The motherboard inside the case is arranged so that peripheral controller boards are adjacent to the back panel, with connectors mounted directly on each peripheral board and readily accessible on the rear panel.

Inside, the impression of solid construction and attention to detail is confirmed. A heavy duty, 2.5mm thick epoxy motherboard provides support and interconnections for all boards in the system. The motherboard is plated through and solder masked on both sides, with Schmitt trigger buffers for all address, data and control lines. Eight slots are provided for full size (50 pin) SS-50 processor and memory boards and eight 30 pin "I/O slots" are available for peripheral controllers. On the motherboard itself are a baud rate generator and DIP switches for assigning addresses to each I/O board.

Power supply arrangements are relatively simple, as each SS-50 board incorporates its own regulators. Total capacity of the supply is 10A at 8V and 2A at ±16V. A computer grade mains interference filter is fitted.



Heavy duty aluminium cabinet conceals a powerful multitasking computer system. For the hobbyist, kit versions of processor, memory and I/O boards are available.

The SS-50 bus

For those who haven't heard of it, the SS-50 bus is a system is a simple, standardised interconnection scheme specifically designed for 6800 systems. Its reliability and ease of use have made it the standard bus for such systems. There is no shortage of boards available either, with over 20 manufacturers producing processors and add-on equipment, all basically to the same standard. The Sphere computer uses the SS-50C bus, which is compatible with earlier versions but includes additional features to take advantage of the 6809's multi-tasking capabilities (more later).

A feature of this bus system is the separation of I/O boards from processor and memory boards. Separate 30-pin slots are provided, bringing out the data and address buses and sufficient control signals to allow input/output facilities to be implemented with a minimum of fuss. The 6800 series microprocessors provide input and output by memory mapping, without the separate I/O features of the 8080 family. In most systems part of the upper 8K of address space is set aside to accomodate peripheral controllers.

Up to eight I/O boards can be installed, while still leaving the main 50 pin bus available to accomodate eight full-sized boards.

As supplied, the Sphere system is provided with a 6809 processor board, 8K, 16K or 64K of memory on another board and a single serial port on a 30 pin board. This means, of course, that a

serial terminal is required to communicate with the computer. We used an 8212 terminal, assembled in Australia from a US design, and set to operate at 9600 baud.

Total cost of a working system is increased considerably by the need to purchase a terminal – especially when compared to an "all in one" microcomputer such as the TRS-80. However, the comparison is really not valid. Multi-user versions of the Sphere can support a number of terminals, providing each work station with the use of processor, memory, disk storage and printers, at less than the cost of providing a complete computer system to each user.

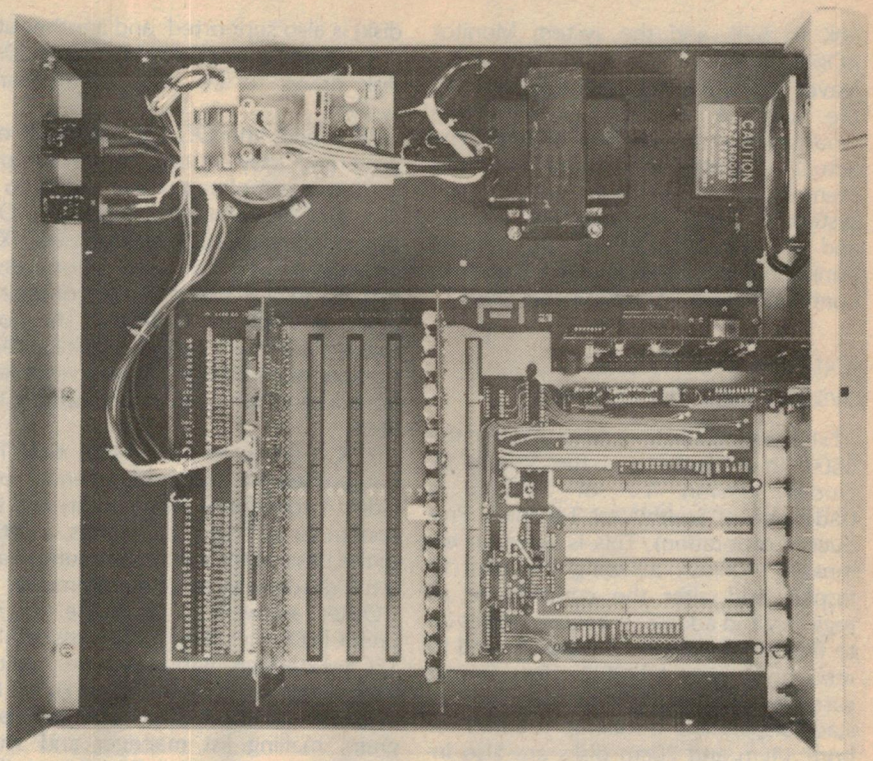
6809 microprocessor

Our review system included a processor board by a United States manufacturer, functionally equivalent to the Sphere MP-09 board. This board uses the 68B09, rated for operation at 2MHz clock speed. At this speed the 6809 processor performs a 16-bit by 16-bit multiplication, for example, in 82 microseconds as compared to 267 microseconds for a 4MHz Z80. Other processor operations show similar speed advantages.

Address translation circuitry is also included on the processor board. This circuitry allows areas of memory to be assigned to different "logical addresses" under software control. While seemingly over-sophisticated for single-user applications, address translation is an integral part of multi-user and multi-tasking systems, and although rarely found on inexpensive computers allows the user to take full advantage of the power of the 6809 microprocessor.

Also on the processor board is a 2K ROM containing the SBUG Monitor from South West Technical Products and three empty sockets which are configured to take 2716 EPROMs. DIP switches on the board allow these EPROM sockets to be assigned addresses in the processor's address space. They are primarily intended for use with a processor board in "stand alone" operation, such as a machine controller.

The processor board also includes buffers for data, address and control lines and a baud rate generator for serial communication when the board is used in the stand-alone mode. Connectors are provided for the front panel Reset and Abort switches. "Reset" re-initialises the system, returning to the Monitor cold start point. "Abort" generates a Non-maskable Interrupt which jumps to a routine in the Monitor which displays the contents of the processor's registers and exits to the Monitor command input routine. It is intended to assist assembly language programers in debugging by halting a runaway program with all registers and memory contents preserved.



Seen from above, with 6809 processor board and 64K memory board in place. High quality motherboard has eight slots for main boards and another eight for I/O. The board at the top of the photo holds fuses, and hides 100,000uF filter capacitors.

Supplied with the system we reviewed was the Sphere MB-64 64K RAM board. This board uses the MM5290 16K x 1 bit dynamic RAM chip with an access time of 250ns. Use of 16K RAM chips provides savings in cost and component procurement time over the new 64K chips, at the expense of greater power dissipation and increased board complexity. A Motorola MC3242 memory address multiplexer and refresh counter chip on the board simplifies the circuitry, however. The memory board is well designed and laid out, and we experienced no problems with its use.

Also available for the Sphere is an 8K RAM board, and a 16K board. As the disk operating system occupies 8K of memory, however, this board is of limited use, although it can be expanded to 32K. All round, the 64K board seems to be the most economical solution in the long term.

With the addition of a memory management board, also forthcoming from Sphere, memory can be expanded to 768K bytes for use with multi-user systems.

In Port 0 of the 30 pin I/O section of the board the Sphere requires a serial board for communication with a terminal. The machine we reviewed contained a serial board by another manufacturer, again functionally equivalent to the Sphere serial board. As supplied, this board provides one RS-232C interface, with a baud rate generator programmable for data transmission speeds between 110 and 9600 baud. The board is designed to be expanded to a dual port serial interface with the addition of the necessary ICs.

A floppy disk controller board was also supplied, in Port 1 of the motherboard. This controller board provides the necessary circuitry to control two 14cm minifloppy drives, and is almost an essential requirement for the Sphere, for reasons which will emerge when we look at the software available.

A wide range of other peripheral controller boards is available, both from Sphere and other manufacturers of SS-50 products. 20cm disks floppy disks and Winchester type hard disk controllers, parallel and serial printer interfaces and optically isolated relay switching boards for appliance control are just some of the equipment which can be added to the Sphere.

A standard configuration for the Sphere system assigns address space from 56K to 60K to I/O boards. The disk controller board occupies memory from

60K to 62K, and the system Monitor ROM is at 62K to 64K. This arrangement leaves 56K of memory space available to the user. A minimum configuration would require at least 16K of RAM. The actual physical addressing of this memory is not important, because the system Monitor automatically locates and all RAM plugged into the system, translating the physical addresses to a continuous area of "logical addresses".

Extensive software available for the Sphere

Extensive software is available for the 6809. In its bare form the Sphere includes version 1.7 of SBUG-E (a trademark of SouthWest Technical Products Corporation). This is quite an extensive Monitor, allowing the user to display and alter the contents of all registers and address locations, to set up to five breakpoints in a program and to read and write MIKBUG (TM) format cassette tapes. A memory test routine, stack display and bootstrap routines for both 14cm and 20cm disks are also included. Calling addresses of Monitor routines for inputting and outputting characters and strings to a serial terminal are given in the user's guide.

The Monitor user's guide is eight pages long, including a three page section for advanced programmers. It is adequate for experienced users, but is in no way an introductory manual.

All other software for the system is on disk. First off and most important is the FLEX09 disk operating system (FLEX is a trademark of Technical Systems Consultants Inc). It is an extensive operating system which has gained great popularity among users of the 6800. This version has been re-written (not just re-assembled) to take advantage of the more powerful instruction set of the 6809. It contains 51 commands for manipulating disk files, many of them with alternate forms and users.

Among other functions, the optional clock calendar available for the computer is fully supported, routines for driving an EPROM programmer are provided, and parallel and serial printer drivers are included. A utility program on the FLEX disk called TTYSET allows the user to customise the operating system to suit his particular terminal, redefining control codes, display formats and data transmission speed.

Disks can be formatted, copied (either in whole or part) and files renamed, deleted, protected and inspected by dumping each sector to the terminal. A further command supports the use of a head cleaning disk. A hard disk system (the Calcomp Marksman Winchester disk) is also supported, and another utility program allow both 14cm and 20cm disk drives to be used in the same system.

All round, the DOS is powerful, efficient and easy to use, giving the programmer complete control access to all files and file handling operations. One particularly important feature is the EXEC command, which is used to process a text file as if it was a list of commands typed in from the keyboard. This command allows very complex disk handling operations to be built up as a command file and executed by simply loading the file.

FLEX is provided on a 14cm disk. The comprehensive operating manual provides procedures for modifying the system to add special features, a listing of the basic 6809 disk driver routines and a full description of each command.

Other software is available to run under FLEX, including a 6809 assembler, TSC's Extended Basic and text editor, Pascal, Fortran, Cobol, C, and Forth. For business use there is an inventory program, mailing list manager and word processing programs. Basic compilers and Uniflex, an operating system which combines the best features of UNIX (trademark of Bell Laboratories Inc) and FLEX is also available, as is UniFlex multitasking Basic and UniFlex Pascal.

As an alternative to FLEX, a multitasking operating system, OS-9, from Microwave System Corporation is available. Multitasking is the ability to execute more than one program at a time, switching the resources of the computer between "task" or programs so quickly that to the user it appears that all the programs are being executed simultaneously.

OS-9 can be used in many ways, from a small "kennel" in ROM controlling a machine tool to a fully expanded timesharing system for business, scientific or educational applications. Two versions are available, Level I for 56K systems (Sphere Mk I), and Level II for systems with up to one megabyte of memory (Sphere Mk II).

With Level II a fully expanded Sphere Mk II can support up to 16 terminals at once.

Forth for the 6809

For this review we were supplied with a copy of Forth, by Talbot Microsystems, written for the 6809 and running under FLEX. Forth was originally developed by C. H. Moore of the National Radio Astronomy Laboratory in the US, and was intended as a replacement for assembly language in the design of real time control programs. In May 1979 the Forth Interest Group (FIG) published a set of standards which have become the model for all implementation of the language.

Forth is a combined compiler, interpreter, assembler and operating system. It runs at almost the same speed as assembled code and uses less memory space. It is renowned for the speed with which programs can be developed. Forth consists of "words" and related groups of words called "vocabularies". Forth words are developed interactively, and when complied consist of lists of addresses which point to machine code routines which do the actual work.

Individual words are either pre-defined or built up by the user by editing blocks of 1024 characters called "screens" using the built-in editor (itself a vocabulary of Forth words). Once defined and compiled these words can be used by subsequently defined words. The equivalent in Basic would be writing a program by writing all the subroutines first and gradually building up to bigger and bigger subroutines, until finally writing one program which simply calls the subroutines under it.

The architecture of the 6809, with its two stack pointers, 16-bit arithmetic and extensive addressing modes is ideally suited to implementing Forth. 6809 indirect and auto increment addressing modes mean that the NEXT loop in Forth – the most used routine which steps through the list of addresses that make up a word – can be written in only 4 bytes, taking 14 machine cycles to execute. Forth is a fast language in any event (from 15 to 20 times faster than Basic in typical cases), and this version of Forth is one of the fastest available.

What does it cost?

With 8K of RAM, the Sphere 6809 system costs $850, with 16K systems at $950. A 6809 with 64K memory board costs $1495. These prices do not include sales tax. An 8212 serial terminal is priced at $1295, with 14cm dual disk drives at $1395. Total cost of the system we reviewed here would be around $4185 plus sales tax, and not including the price of the software.

A copy of "6809 Microcomputer Programming and Interfacing", from the Blacksburg education series is included with each computer.

For the constructor, cabinets and motherboards are available separately, and kit versions of the necessary boards to construct a single-user system can also be supplied.

Sphere computers are distributed by Paris Radio Electronics, 7a Burton Street, Darlinghurst, NSW, 2010, and J. H. McGrath, 208 Little Lonsdale Street, Melbourne, 3000. Postal address is Sphere Computers, PO Box 380, Darlinghurst, NSW, 2010.

PARIS RADIO ELECTRONICS

HARDWARE DESCRIPTION

S/09 6809 Computer w/128K Memory
/09 6809 Computer w/56K Memory
6540 Printer 132 characters
8212 12" Terminal w/monitor
DMF 2 Disk System w/2.5m Capacity
CDS-1 Winchester Hard Disk System
MP-09A 6809 Process/Board (assem)
D5-2 double side/double density 720KB
3809 128K Memory Expansion for S/09
MP-LA Parallel Interface
MP-L2 Dual Parallel Interface
MP-N Calculator Interface
MP-R Eprom Programmer
MP-S Serial Interface
MP-64 Memory board 64K
MP-S2 Dual Serial Interface
MP-SX Serial Interface Expansion
MP-T Interrupt Timer
S-32 Universal Static Memory Card
MB 68XX 6809 Mother Board

INTRODUCING

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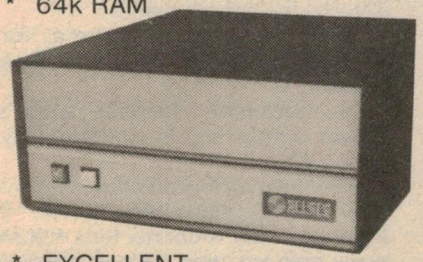

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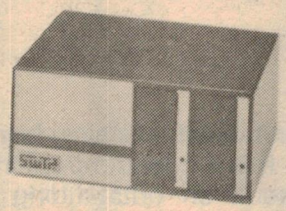
* MULTI USER AND MULTI TASKING

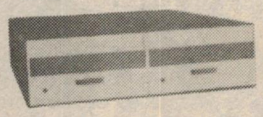
PERIFERALS

Additional VDU's, Dot Matrix Printers, Daisy Wheel Printers, 8" and 5" Floppy Disk Systems, and a hard disk drive of up to 40MB may be connected to the system. Interface boards and software are available to support all these devices in a singular or multi-user environment.

D-5 Two double sided, double density, 5" disk drives with a total on line capacity of 720,000 bytes of data. Includes cabinet, power supply, connecting cable and controller. Controller will operate up to four drives. This is an ideal disk system for small stand alone word processing systems, or for businesses that do not work with large inventories.



DMF-2 Double sided, double density, dual eight-inch disk system with an on line capacity of 2,400,000 bytes. Our "top of the line" disk system features a DMA type controller for fastest possible data transfers. This drive was designed for larger businesses and multi user installations. The DMF-2 will provide the fast operation necessary for systems running multiterminals under the UniFLEX operating system. Complete with a heavy duty 1/8 inch metal cabinet, power supply, connecting cable and controller. The controller will operate up to four drives.



DMF2

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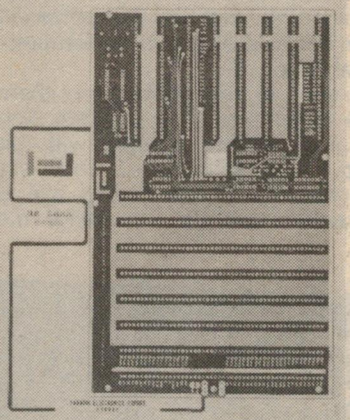

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Electronics Australia reviews the

Yaesu FT-ONE amateur transceiver

The Yaesu FT-ONE transceiver is a unit which certainly is in keeping with the latest technology standards. It is a new concept in amateur transceivers with features that make it an outstanding piece of amateur station equipment.

The purpose of the review was not to check that the unit met the specifications given but to evaluate its performance in actual on-air use.

As seen in the photograph there is quite a lineup of lever switches, knobs, and push switches, together with tuning knob, LED indicators, and digital readouts. Six of the knobs are dual concentric controls. The outer meter reads operating conditions selected by the meter switch (top left hand) while the inner meter indicates signal strength and ALC value. The bottom right hand corner is the computer processing unit (CPU) keyboard, which controls the operating frequency, scanning, and VFO selection. Under the tuning knob are the fine and fast tuning, clarifier and frequency lock switches.

On the rear panel are the connections for external attachments, (linear amplifier, VHF transverters) antenna, ground, AC power, DC power, external speaker, FSK and CW keys, fuses, and memory backup power switch.

Controlled by a microprocessor, the flexibility of the FT-ONE on transmit and receive is excellent. Frequency determination is achieved by the CPU and controlled by the keyboard. The keyboard also controls the memory banks for the two ten position VFO's and the auto and manual frequency scanning facility.

Although there are a large number of controls it is easy to operate. However, to obtain maximum efficiency the operator needs a good understanding of the functions of each control, especially the bandwidth, IF, audio peak frequency, notch filters and the RF speech processor and compression controls. In some cases interaction occurs when setting the controls to achieve a desired effect.

Transmission and receiving modes are: LSB, USB (A3J/J3E); CW (A1/A1A); AM (A3/A3E); FSK (F1/F1B); FM (F3/F3E). Designations in brackets are as per WARC 79.

The frequency range of the FT-ONE is 150kHz to 30MHz on receive, continuous coverage. No switching is required for setting various bands or segments thereof. Full coverage tuning can be controlled by the main tuning knob or the manual or auto scanning facility.

Tuning rate is normally 20kHz per turn of the tuning knob, in 100Hz steps. The fine tune switch allows the rate to be reduced to 2kHz per turn in 10Hz steps. A 1MHz switch allows that tuning rate over the whole range. In the auto position scanning up or down in frequency is in 100Hz steps. In the manual position scanning either 100Hz or 100kHz can be selected.

There are no "preselector" or tuning controls for peaking the received signal. The receiver band pass filters are selected automatically to correspond to the operating frequency.

The transmitter covers all the amateur frequency bands including the new WARC 79 allocations in the 10MHz, 18MHz and 24MHz bands.

Tuning steps are the same as for the receiver and can be selected in the same manner.

The transmitter features solid state power output and is controlled by the 4-bit CPU.

Automatic final protection as provided will restrict transmitting power if an improper load is connected. A standing wave ratio less than 2:1 is recommended and at that ratio the power is reduced to about 90%. A 50Ω load must be presented to the transceiver. Facility to check the SWR is provided and the procedure is given in the transmitter tune-up instructions.

The frequency determination and memory facility together with associated switch positioning allow a wide choice of operating frequencies to be very easily selected. As well as transceive operation, split frequency and cross-band operation is made easy. Reversal of transmit and receive frequencies as well as change of sidebands is readily achieved.

Frequency readout is a digital display with resolution to 100Hz. A miniature display indicates the VFO operating channel and when the clarifier is activated it indicates the amount of frequency offset, plus or minus, required to zero beat a signal. The clarifier has a

range of plus or minus 9.9kHz, in frequency steps of 100Hz. Used with the fine tune button the step rate is 10Hz.

The RF power output checked on a Bird Wattmeter was in excess of 100 watts.

On SSB the reports on quality and sharpness of signal ranged from very good to the best SSB signal heard. Such reports were received from amateurs professionally engaged in broadcasting and audio work. Also, reports were that the RF speech processor did not deteriorate the audio quality. The automatic microphone gain control (AMGC) and VOX (voice operated TX/RX switching) were smooth in operation and effective. Both local and DX reports concurred, including one from a short-wave listener who was listening to checks being given.

Observing the FT-ONE performance when operated by an experienced and very capable CW operator provided an opportunity to assess its capabilities in that mode, both with normal keying and with the optional electronic keyer fitted. Full break-in "QSK" operation was excellent even at 50wpm. And the use of bandwidth, IF shift, audio peak frequency and notch filters allowed very weak signals to be copied with relative ease. The operator's comment was – "Its performance is a CW operator's dream, particularly for contest operation." There was complete absence of key clicks or thumps, or noticeable desensitizing of the receiver. Operation using a keyboard was similar.

Reports received during radioteletype contacts were very complimentary, noting how clean and sharp the transmission was. The FSK shift circuit is designed for 170Hz. The frequency displayed is the true carrier frequency. However, the keying is set in the reverse sense and with the RTTY terminal unit used it was necessary to use the reverse sense on transmit, returning to normal on receive, which was AFSK from the phone jack. As with CW the bandwidth and IF filters could be used to advantage.

Audio power output of 3 watts naturally overloads the inbuilt speaker and judicious use of the audio gain control is necessary. However, with an outboard speaker that restriction is eliminated.

The bandwidth control can be used as a tone control when receiving SSB. On AM, full bandwidth provides normal domestic quality from local and overseas broadcast stations.

Other features are: the easily readable LED indicators showing which of the various functions are in action; receiver RF attenuator which is continuously variable reducing the strength of the incoming signal to the receiver front end circuit; scanning control from microphone and no frequency drift detected or commented on.

Overall dimensions are 380mm (W) x 165mm (H) x 465 mm (D) and mass is approximately 17kg. Optional fitments are electronic keyer (used during evaluation) and FM unit.

The FT-ONE is an exceptional piece of amateur equipment, pleasing in appearance with good front panel layout. It is solidly constructed. Internally it is well engineered.

Frequency selection from the keyboard and VFO memory bank is simple, any incorrect entry is indicated by "E" in the digital display.

Although no detailed circuit or block schematic are included in the operator's manual, there is no difficulty in installing optional fitments if instructions given are followed. However, the reviewer felt that the manual should be more explicit in some areas.

The cooling fan runs continuously and was quite noticeable and should be made quieter if possible.

The FT-ONE performed as would be expected from the specifications. In fact, some specifications seemed quite conservative.

During evaluation many local and DX contacts were made on all amateur bands except 1.8MHz. Modes used were SSB, CW, AM, and RTTY, all performing equally well.

For the amateur who wants a top quality transceiver, for whichever mode preferred, the FT-ONE will meet those requirements. The unit under review was supplied by Dick Smith Electronics. Price $1795. (P.J.H. VK2APQ).

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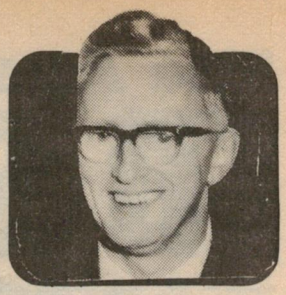
SHORTWAVE SCENE



by Arthur Cushen, MBE

Media network introduced by radio Nederland

The weekly DX Juke Box broadcast by Radio Nederland has been replaced by Media Network — a restyled, wider ranging program which now covers many areas of interest to the shortwave listener.

Since Jonathan Marks has been compere of Radio Nederland's Thursday program the style has changed considerably. A broader range of interests is being catered for, from computers through to slow-scan television and the future of shortwave broadcasting, including direct reception from satellites. Each week there is a DX report from one of the four regular contributors and news highlights from the communications field.

The station backs up many of these programs with free information and courses on DX listening and antennas, and has available a shopping list of communications receivers and a book list to aid the shortwave listener.

A telephone line is available 24 hours a day to record comments from listeners throughout the world who phone to the Hilversum studios. On some occasions a special program for Asian listeners has replaced the Media Network broadcast, and when there are five Thursdays in a month Media Network is replaced by Hitch-hikers Guide to DXing, a popular parody on international broadcasting. The next program is scheduled for April 29.

During January and February the program highlights are:

January 7 – DX News with Arthur Cushen and Media Round-up.

January 14 – Dutch ethnic stations in the USA, DX News with Richard Ginbey, Clandestine news with John Campbell.

January 21 – Preparations for WARC 84, DX news with Dan Robinson, WRTH news spot with Andy Sennitt.

January 28 – Asian special, DX news with Victor Goonetilleke, and Review of International Broadcasting.

February 4 – Dutch domestic radio, and DX news with Arthur Cushen.

February 11 – DX news with Richard Ginbey, and John Campbell's Clandestine news column.

The DX reports are covered by Richard Ginbey reporting from South Africa, Dan Robinson from the United States, Victor Goonetilleke from Sri Lanka, and Arthur Cushen from New Zealand.

Media Network is broadcast at 0747UTC on 9770kHz and 9715kHz and again at 0847UTC at 9715kHz each Thursday.

RADIO VERITAS ASIA

In 1958 a decision was made to establish a Catholic Missionary Radio in the Philippines and in 1969 the first transmissions on shortwave were broadcast. In 1973 the station extended its services and has gradually increased the number of languages broadcast and the range of frequencies used. Radio Veritas uses two 100kW and one 50kW transmitter and six directional aerials to cover Asia. English is carried four times each day and can be heard at 00300-0100 on 15135, 15280 and 17785kHz; 0300-0330 15215, 15280, 17785kHz; 1130-1200 on 9535, 11770, 15215kHz and 1430-1500UTC on 9535, 11955 and 15215kHz. The address of the station is: Radio Veritas Asia, PO Box 939, Manila, Philippines.

DEUTSCHE WELLE 25 YEARS

Though the first broadcasts from post-war Germany were carried out in May 1953 from Osterloog using two 20kW transmitters, it was not until April 1, 1956 that high powered transmitters were used from the new site at Julich. This was a 100kW transmitter and in 1960 another four transmitters were added. In 1961, the West German Post Office took over the Julich transmission centre from the West German Broadcasting Corporation. Since then the Post Office has owned and run the antennae, masts, transmitters and technical installations.

Frequency changes

INDIA: There are two transmission periods to Australia from All India Radio, Delhi. The first, for evening reception 1000-1100UTC, is on 15205, 15285 and 17875kHz. The morning transmission to this area 2045-2230UTC is now broadcast on 9912, 11755 and 15110kHz.

SWITZERLAND: Berne, with programs of Swiss Radio International, has two English transmissions to Australia 0700-0730 and 0900-0930UTC on 9560, 15305, 21520 and 21695kHz. The balance of the program is Italian 0730-0800, French 0800-0830, and German 0830-0900UTC. A transmission for Western Australia 1315-1515 is on 15305, 17830, 17785, 21520 and 21570kHz with English 1315-1345UTC.

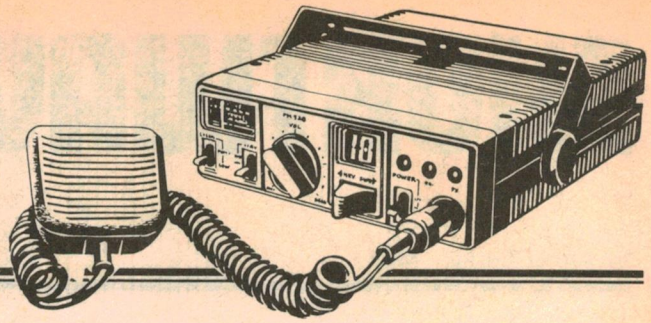
BELGIUM: Two broadcasts in English are heard from Brussels each day, with best reception 1705-1750UTC. Two frequencies, 6010 and 17595kHz are used. The second transmission to North America at 0015-0100UTC is now on 9515 and 11860kHz, but the first transmission may be rescheduled to 2000-2045 UTC.

ITALY: Rome Radio has made a frequency change for its broadcast in Italian to Australia at 2050-2130UTC. The new frequency is 7235kHz, which replaces 15405kHz, while 9575 and 11800kHz carry the same program. The Italian broadcast for evening reception 0830-0930UTC is on 9580, 11810, 15330, 17780 and 21615kHz. A broadcast in English at 0350-0410 is on 15330, 17795kHz and 11905kHz.

NORWAY: Radio Norway at Oslo is dropping the use of some of its high frequencies for the present transmission period up to March 6. The broadcast best received in Australia is at 0700-0830UTC on 11850, 11895, 21730 and 25730kHz. The broadcasts at 1100-1230 are now on 15135, 21730 and 25730kHz, while for our afternoon reception the transmission at 0500-0630 is carried 9590, 15135, 15175 and 21730kHz. The 25615kHz frequency which was using a 100kW transmitter, as against 250kW on most other frequencies, has been withdrawn from most of the transmissions. Norway has programs only in Norwegian except for the Sunday program when the last 30 minutes is in English.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT. In areas observing daylight time, add a further hour.

The Australian CB SCENE



Self-help possible when buying CB antennas

According to Greg Ackerman of Mobile One, the least efficient way of purchasing a CB antenna is by mail order on a one-off basis. The cost of packaging, invoicing and despatching a single antenna is out of proportion to its unit value.

There are two sides to the matter, as explained to me in a recent letter from Greg. He is the first to admit his indebtedness to CB and he continues to fill the many orders he receives from individual operators for single antennas. But he is conscious that multiple small orders are costly in terms of staff time, as well as costing the customer proportionately more for package and delivery.

Greg has asked me to suggest that, if any of you are contemplating buying one of his antennas, you check around your friends and try to get a bulk order together. The same applies to clubs, of course.

For sure, it will cut down the workload at Mobile One but it will also reduce freight costs and could provide grounds for a discount. If you want to follow this up, get in touch with Greg Ackerman at Mobile One Communications Systems Pty Ltd, 17 Sloane St, Marrickville, NSW. (Phone 02 516 4500).

LIMA MIKE CLUB: Towards the end of last year, Ken Upton wrote to me on a couple of matters which didn't get into print at the time, either because of lack of space or because they missed deadlines. Here they are:

Last September, the Lima Mike club of NSW held an on-air auction to help out the "Foundation 41" Appeal. They also held a Disco (on skates), a Bingo Night and several raffles. The overall tally (to the date that Ken wrote) was $1,885.76. A terrific effort, I am sure you will agree.

The Lima Mike club also runs a CB broadcast each Sunday morning at 9.00am on 18 USB (Aust) which incorporates segments on club news, news from other clubs, items for sale and community sevice announcements. The club hasn't missed putting on a broadcast for the three years since its inception, even though it means that two of the members have to get up very early each Sunday morning and drive up to Mt Tomah in the Blue Mountains. It seems to be worth the effort, as it appears that the broadcast reaches all of Sydney, and into Newcastle and Wollongong. Any person or club who would like to have something put over on the broadcast is invited to write to: The Sydney Sunday Morning Broadcast, PO Box E32, Emerton, 2770. Keep up the good work, Lima Mikes.

FORTY CHANNELS: By now, many of you should be enjoying the pleasures of operating on a 40-channel HF band. Operation should be much more relaxed, with the extra breathing space.

The calling and emergency channels are now protected by law, and I trust that you will all do your bit by pointing out to young and/or errant operators that the days of being able to play around on these frequencies are, at long last, well and truly over.

It is up to the Department to emphasise that the new legislation, long sought by responsible operators, will not be pigeon-holed. There are many instances in the capital cities where this new legislation could be invoked without too much effort, and a few well-publicised prosecutions would act as a deterrent to the troublemakers.

TV PROBLEMS: I would like to take this opportunity to set the record straight in relation to TVI problems. In the "bad old days" it was practically automatic that if you were the cause of TVI you were closed down. These days, however, the Branch has a more realistic approach to the problem. As long as you are operating "clean" equipment, the Inspectors will look seriously at the TV receiver to see if that is the culprit. If it is, you have nothing to worry about. Even so, it is better to try to solve the problem on an amiable basis with your neighbour first, before the Branch is brought into into.

RADIOCOMMUNICATIONS BILL (1981): Some time ago I mentioned that the NCRA had drawn up a submission on draft proposals for the Radiocommunications Bill (1981). To date, we still have not seen the proposed draft of the Bill and, as I am writing this, 1981 is fast drawing to a close. It was hoped to have the Bill put through all stages of its readings in both Houses during the final session for 1981 but this does not seem to have happened. It is a pity, because we have all laboured under the cumbersome weight of the Wireless Telegraphy Act (1905) (as amended) for much too long.

CRRA AND NCRA JOIN FORCES: Towards the end of 1981 (again) the Citizens Radio Repeater Association (CRRA) and the National Citizens Radio Association of Australia (NCRA) agreed to terms of Association and there are now formal ties between the two bodies. As the National Liaison Officer for the NCRA I am pleased to be able to make that announcement, because it means that now we have the best possible advice available regarding UHF that we can draw on. The NCRA's history of achievements for the 27MHz operators is well known, but we have, admittedly, been short on expertise in the UHF area. We all hope that the association will be a long and rewarding one for both organisations. It can only benefit the operators.

PERSONAL FOOTNOTE: My first formal role in the world of CB was as secretary of the Little Wheelers of Brisbane CB Club. In that position, I came into contact with Terry Watkin, who was Queensland State Secretary of the NCRA. Subsequently, I became Assistant State Secretary and . . .

We recently became engaged and are to be married in a few months time. I just had to tell you!

Well, that's it for another month. Don't forget to send any items of interest you may have to me at The Australian CB Scene, P.O. Box 406, Fortitude Valley 4006.

Jan Christensen

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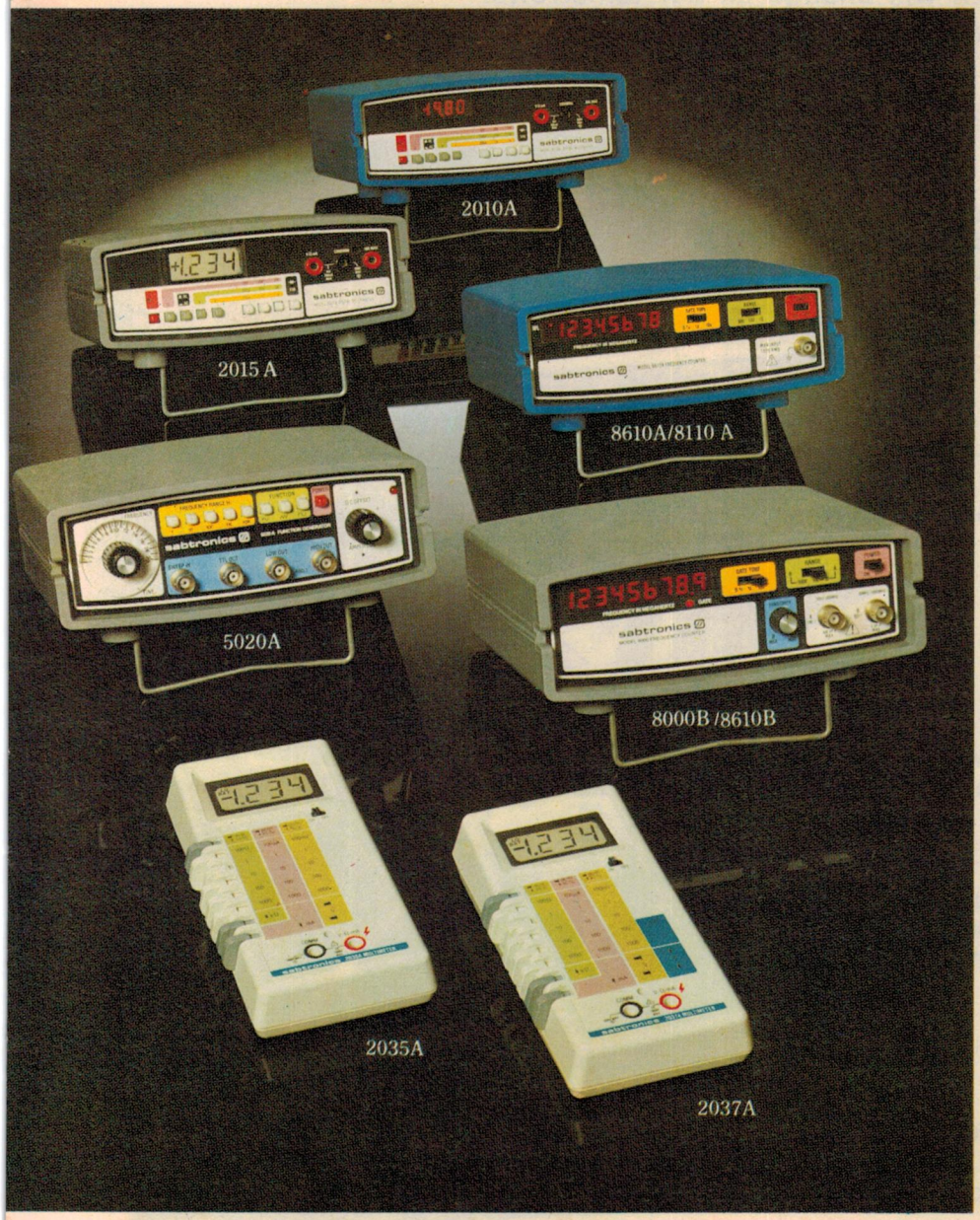

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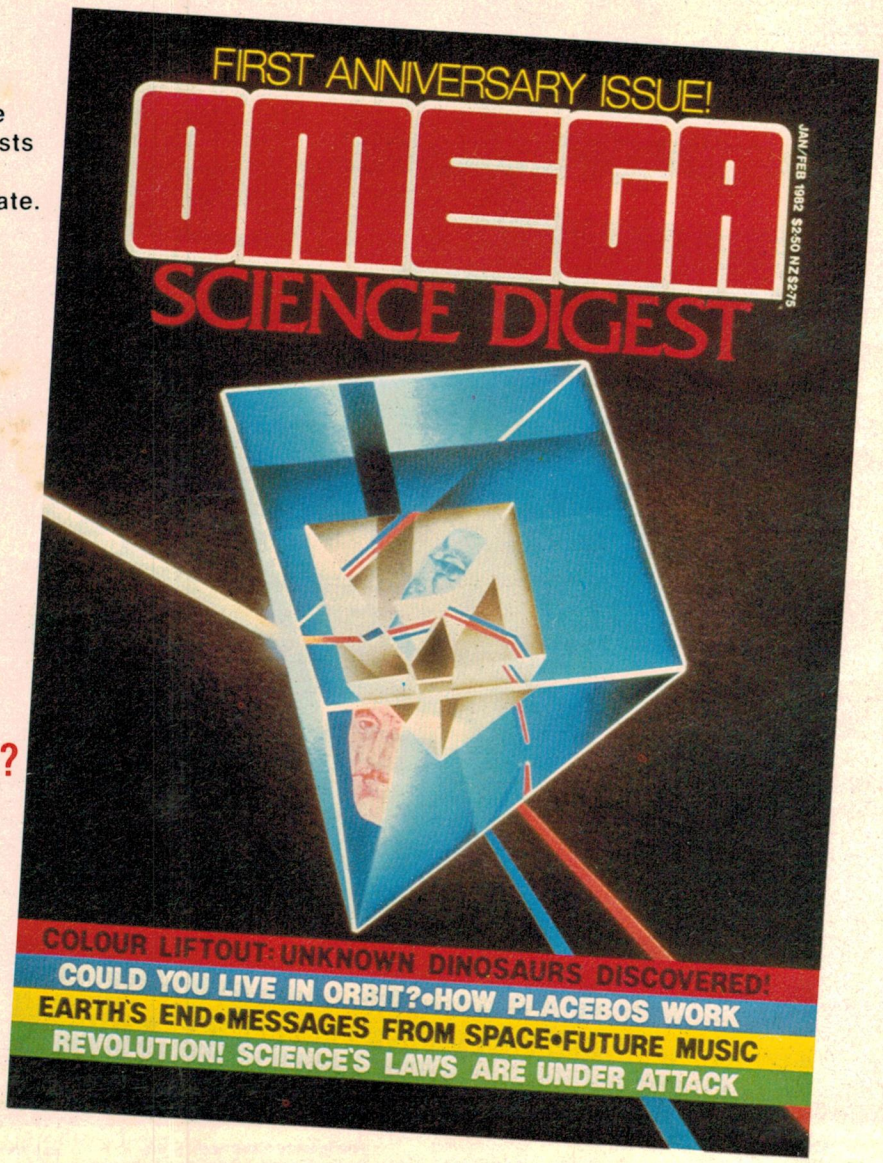

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ON SALE AT YOUR NEWSAGENT

AMATEUR RADIO

by Pierce Healy, VK2APQ

Education in electronics — a WIA service

The cost to the community of our education system and claims made by asociated organisations receives much publicity in news services. But the specialised educational assistance provided by individuals or groups as a community service do not make the headlines.

One such community service is that provided for those interested in electronics. This service is available through the Wireless Institute of Australia and some radio clubs. No government financial assistance is received and the cost to the individual attending classes is kept to a minimum.

This service has the reputation as a source of at least basically trained persons for the radio, electronic, and communication industries. It also leads to participation in a rewarding hobby — amateur radio.

Started over thirty years ago, the WIA "Youth Radio Scheme" is still functioning as a national organisation. Basically a scheme to introduce students to electronics and amateur radio, the syllabus and training methods have been adopted by radio clubs and, in a number of cases, education authorities, who have included YRS activities in school cuirricula.

Certificates for various grades are awarded to YRS students who are successful in passing examinations conducted along normal educational lines. The achievements of students are recognised by many personnel officers as a true indication of an applicant's knowledge and aptitude.

While the YRS is run on a state division basis, education is a significant part of WIA activity on a federal level. In particular WIA collaborates with the Department of Communication, Radio Branch, on matters relating to amateur licence examinations.

In May, 1981, Brenda Edmonds, VK3KT, took up the position as WIA federal education officer. In a note from her, Brenda comments on the aims and scope of her task and also on the assistance available through the WIA federal office.

"A major part of my effort is directed towards helping intending amateurs to become qualified operators. To this end a list has been compiled of clubs and educational institutions which offer courses of instuction. It is also intended to provide a trial examination paper, to be available about six weeks prior to each exam date. Copies of Morse code tapes used in past DOC examinations are available.

"Another aspect is liaison with the DOC Radio Branch. A recent development in this field has been the designation of part of the radio regulations as non-examinable. This does not mean that the regulations no longer apply, just that candidates will no longer be asked questions on them. The examiners have also asked the WIA to have a further look at the Novice syllabus with regard to the degree of detail required in some sections. However, no change in topics is contemplated.

"In liaising with the Radio Branch, statistics have been received based on several recent amateur examinations. Pass rates are much as would be expected — higher for regulations than theory, slightly higher for novice theory than full theory, higher for Morse code (CW) sending than receiving. Graphs showing the number of candidates and marks obtained in the theory section of examinations do not show a marked peak at 66% or 68% (70% being the pass required), contrary to popular belief."

Referring to some disappointment expressed about the low pass average for the theory section — 30% to 45%, Brenda comments:

"This probably reflects the 'give it a go anyhow' attitude which is encouraged by some class instructors, also the low examination entry fee."

To help in correlating as much information as possible, Brenda asks for details about classes or courses at any level, such as — where, when, who for, cost, and who to contact. She is also anxious to establish contact with class instructors with the view to establishing a bank of resource material for each section of the examination syllabus.

Also useful would be comments on education, examinations, or syllabus matters, course instructors' notes, reference lists, or questions for use in examinations. Information about advanced or postgraduate courses that may be running in clubs or schools especially TAFE colleges is also requested.

Available through the WIA Federal Executive, PO Box 150, Toorak, Vic, 3142, are copies of Morse code tapes at 5 or 10wpm (send a blank C60 tape), copies of trial examination papers, (regulations and theory) information and advice relating to classes or courses available, and information useful to class instructors.

For YRS information contact — Ken Hargreaves, VK2AKH, 52 Marlin Avenue, Floraville NSW 2280, or Roy Hartkopf, VK3AOH 34 Toolangi Road, Alpkington, Vic 3087.

The national YRS magazine "Zero Beat" together with notes, Novice kits, 1000 questions, 500 questions for AOCP, 50 basic projects books, learning Morse code kits, and Morse code tapes at various speeds, are available. Write to David Wilson, VK2ZCA/NMW PO Box 262, Rydalmere NSW 2116 for details.

All work by those mentioned by name, and many others associated with the WIA education projects, is done on a voluntary basis as a service to the community.

CW NETS

Amateur radio is a world-wide hobby with many activities and interests. One activity which has maintained steady support is the use of Morse code (CW) for communication, in spite of some claims that it is an outdated and unnecessary mode.

Each Sunday morning at 10am EAST, a group dedicated to the continued use of Morse code meets on 7025kHz.

This group, known as CWN (Morse code Net), assembles when the rostered net control station calls "CQ CWN" followed by his/her own call sign.

Members of the group, using standard "Q" code net terminology, acknowledge the net station call with "QNI" (I am checking into the net). The net control station (NCS) will acknowledge all calls and arrange pairs among the stations to

AMATEUR RADIO

contact (QSO) each other on a suggested frequency. On completion of the QSO stations return to NCS for repairing or "QNX" (I wish to be excused from the net). The NCS acknowledges accordingly. The net continues until noon when the NCS holds a final roundup and lists all the members who have joined the net during the session.

This brief description of the CWN is given to encourage any amateur, wishing to improve his conversational CW ability, to join in the activity.

All members of the net are happy to send slowly to newcomers so do not be afraid to "QNI".

Further details from Max Riley, VK2ARZ, at his call book address.

Morse code practice transmissions are made each night at 7.30pm on 3550kHz and, in Sydney, a 24 hour continuous transmission at various speeds can be heard on 147.400MHz. These transmissions are made on behalf of the WIA and radio clubs.

VK2APQ SAFARI TO VK3 TERRITORY

What to expect when you travel interstate cannot be forecast, particularly if you have a small two metre transceiver with you.

Taking advantage of an opportunity in mid-October, 1981, to go to Melbourne, Victoria, to visit relations the IC215 two metre pack set was again included with the toothbrush, electric shaver and clothing.

The trip from Sydney to Melbourne and return was made overnight on the Southern Aurora; a very comfortable trip which allowed maximum daylight hours in the southern metropolis.

After finalising accommodation in a mid-city hotel and arranging suitable visiting times to see relatives, thought was given seeing or telephoning as many amateur friends as time would permit.

The first visit was to the WIA federal office in Caulfield North, where an afternoon was spent with Peter Dodd, VK3CIF, business manager, WIA federal executive. Naturally the discussion centred around amateur radio both national and international. While there I was able to participate in telephone conversations with several members of WIA federal executive.

A more current subject discussed at length was the preparation and collection of material for a series of books on the history of amateur radio in Australia and the WIA, which celebrates its 75th anniversary in 1985. The books are to be published by the WIA and will no doubt become the official history of the contribution made by amateurs in the pioneerng work and growth of radio communications in Australia.

For this project any books, papers, photographs, news cuttings or personal recollections of the early days of radio communication in Australia either on loan, copied, or donated to the WIA achives will be appreciated by Peter Dodd and federal executive.

Next morning was spent with Max Hull, VK3ZS, past federal president, and currently WIA federal historian. Again the discussion centered around events associated with the early days of wireless and reminiscences of our association in WIA federal activities of the 1950's – 1970's. Max would also appreciate information in any form to fill in gaps or expand known facets of amateur radio during the past years.

It was late in the evenings that the Icom 215 proved to be a worthy room mate on the fourth floor of the hotel. A call through repeater VK3RML resulted in several interesting contacts. One was with Max Dawkins, VK3TR/M who called to say thanks for the publicity given to the Jamboree-on-the-Air in these notes (October 1981) and extended an invitation to join Saturday afternoon JOTA activities at the Victorian Scout Headquarters Branch station, VK3SAA, from the lawns of Government House, Melbourne. The invitation was accepted with pleasure.

So, a very pleasant Saturday afternoon was spent meeting Max Dawkins, VK3TR, Mike Thorne, VK3BKK, Ron Fisher, VK3OM, and his wife Lyn, together with senior members of the Victorian Scout and Guide associations and scouts and guides present.

The JOTA opening address was made by the Governor General Sir Zelman Cowen from his residence in Canberra, through VK1BP. Reception was excellent in Melbourne and VK3SAA joined in the official station call back.

While at government house the opportunity was taken to use the IC215 operating as VK2APQ/P3. Contact was made with VK3DJR/P a scout JOTA station in Burwood (Vic), and with VK3SAA, the shortest distance contact, and the quickest delivery of a QSL card.

In addition to VK3RML it was quite easy to work through VK3RGL near Geelong and VK3RMM Mount Macedon repeaters from my hotel room. Contacts were made through VK3RMM with VK3CO at Seymour, VK5AVR at Naracoorte, SA, and VK3DIF/P, operating from his sleeping berth aboard a train on his way home to Mildura.

Finally I bid farewell to the Melbourne repeaters from my sleeping berth about thirty minutes out of Melbourne when VK3ATL/P operated by Daryl, VK3AQR, was worked through the Geelong repeater VK3RGL.

So during the short stay in Melbourne VK2APQ/P3 contacted several VK3's, VK4YC/P3, VK5AVR and JOTA stations VK3SAA and VK3DJR/P. The hospitality extended and the use of the repeaters is appreciated.

It was a pleasure to meet and say hello to new contacts and the old friends acquired over a quarter century or more.

That is the true spirit of out hobby – amateur radio.

OCEANIC RESEARCH EXPEDITION TO THE ANTARCTIC

Don Richards, VK2BXM, is the radio operator on board the Oceanic Research Foundation yacht "Dick Smith Explorer" now on its way to Commonwealth Bay on the Antarctic continent. Don is an experienced maritime mobile operator, a previous venture being in the Sydney-Noumea Club-Med race.

During the four month voyage regular schedules have been arranged for contacts between the yacht and Sydney amateurs.

Co-ordinator for the Sydney link is Pierce Healy, VK2APQ with Barry White VK2AAB and Mike Barry, VK2IH as backup.

Frequencies used will be 3620kHz, 7050kHz, 14.105MHZ, 14.322MHz and 21.220MHz on SSB. Scheduled times are 0900UTC during daylight saving periods and 1000UTC when daylight saving ends – both corresponding to 8.00pm Sydney time.

SPECIAL EVENT CALLSIGN PREFIX

The Department of Communications has given permission for Australian amateurs to use the "AX" prefix in lieu of "VK" during the Commonwealth Games in 1982.

The "AX" prefix may be used from 15th August, 1982 to 15th November, 1982, inclusive.

Radio clubs and other organisations, as well as individual amateur operators, are invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown.

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Cat BE7100 'COSMAC Users Guide'	$5.00

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Babani Books

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BE0227 Beginners guide to electronic projects. BP227	$4.60
BE0078 Practical computer experiments. BP78	$6.50
BE0086 Introduction to Basic programming techniques.BP86	$6.50
BE0225 Practical Introduction to Digital ICs .BP225	$4.60
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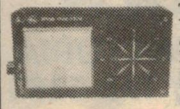
BE0024 52 Projects using IC 741. BP24	$3.50
BE0211 First book of Diode Characteristics, equivalents and substitutes. BP211	$4.60
BE0087 50 simple LED circuits, book 2. BP87	$4.60

GREAT NEW KITS

Wind Direction Indicator

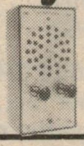


This kit adds on to your Wind Speed Indicator. You get a new head with 7 reed relays for direction sensing, a new circuit board with LED driving IC and LEDs and a new front panel for your existing speed indicator.

Note:This is an add-on kit.

Cat Number KE1631 **$25.00**

Easy Build Metronome



This EA design is very easy to get going and comes complete with tough Zippy box. It features an inbuilt speaker as well as flashing LED for keeping time. There are 2 controls, for volume and rate.

Cat Number KE1065 **$17.50**

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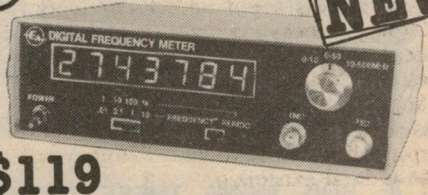
NEW



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Cat KE1815 (kit to convert to 500MHz) $25.00

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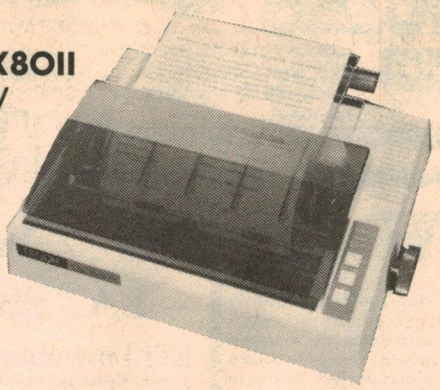

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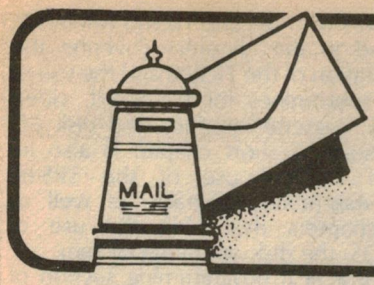


Letters to the editor

The reason for that half-size PCB

I have been subscribing to "Electronics Australia" since 1970 and generally find it to be informative and thorough. I was prompted to write to you, however, after reading the August 1981 issue. There on page 53 was a photograph of a PCB layout for the Musicolour IV – but it was only half actual size.

This is one of the first times I have seen EA do this and I assume you have done it for two reasons.

- Because the circuit has mains potential on parts of it – if the PCBs were purchased by constructors, errors made in the PCB would be eliminated.
- It is good business for the suppliers of PCBs.

The main point I want to make is that I hope you are not going to continue this practice. For me, making the PCB for a project is all part of the fun, and buying the PCB ready-made takes all the work, for the hobbyist especially, right out of it. There is a certain amount of satisfaction in drawing, etching and drilling a PCB and once the components are soldered in, having it work correctly.

This satisfaction is lost if you start with a ready-made PCB. I think that for the safety reasons mentioned – with respect to projects like the Musicolour – buying the PCB is a good idea, but for the normal low voltage circuits you publish, a hobbyist is definitely missing out on a facet of project building if he buys ready-made boards.

The other point I wish to raise is that while you did emphasise the danger of the heatsink being at mains potential (and used opto-isolated Triac drivers), nowhere did you mention that the unit should be checked by a registered radio serviceman or technician. I understand that in most states in Australia, you have to be registered to carry out mains wiring within an appliance (as a NZ registered tradesman I can confirm that this law applies throughout New Zealand).

Because EA is aimed not only at Australian hobbyists but NZ hobbyists, I feel you should either warn prospective builders to have it checked by someone so registered, or suggest a few simple tests to be carried out before switching the unit on. The unit, once switched on, could function correctly but also the metal chassis may be touching the Triac heatsink – and hence be at mains potential if a chassis mains earth was accidentally omitted. These checks are standard practice for a tradesman but just extra time to wait before "switch-on" for the hobbyist. A simple mistake could in the wrong circumstances be fatal.

D. J. Worth,
Waihi, NZ.

COMMENT: Our policy is to present PCB patterns full size, where possible. In the Musicolour article, already spread over eight pages, we had simply run out of space – to publish the pattern full size would have taken a full page! In our designs, we follow the guidelines laid down by the Australian Standards Association in relation to mains potential wiring. The article emphasised the need for care, in several places. Hopefully, readers building this kind of unit and, by implication, handling an array of entertainment lighting, will be aware of regulations in their local area.

True Peak-Reading DC Voltometer

I refer to the "True Peak-Reading DC Voltmeter" submission in Circuit and Design Ideas for November, 1981. By inspection I feel that it will not work. After viewing the circuit as printed, I assumed that the placement of D1 was due to a printing error but after reading the text I realised that there was a design error.

Because of the placement of D1, the only current which can flow to charge or discharge Cx is Id. Therefore, the voltage across Cx can never be positive but will grow steadily more negative with each negative peak of the input signal, since Cx is allowed to charge negatively through the inputs to the op-amps. The circuit will eventually behave as a voltage follower.

In the description, D1 is described as restoring the DC offset created by D2. This is not so. There is no DC offset produced by D2. The output of op-amp IC1a will pull up until Vp is greater than or equal to Vin.

The complete omission of D1 would make the given circuit work as a true peak-reading voltmeter. The addition of the term "DC" is erroneous since there is no need for a peak reading meter if the input signal is DC. This meter adaption is, in fact, used for measuring the positive peak value of an AC waveform rather than measuring its DC offset.

Philip Wilson,
Springvale 3171.

COMMENT: Thank you for your letter. We agree with your comments.

Help wanted with historical material

I am writing to you with a request. Would it be possible for you to place a paragraph in the magazine, asking your readers to contact me if they have any material appertaining to my late father's career in radio?

My father, Cyril Angles, made his first description of a horse race from radio station 2KY in 1931 and during his career he described many other sports including golf, trotting, greyhound races, football, boxing and billiards.

He was emloyed at radio stations 2KY, 2UW, 2GB and 2UE.

Two years ago, at the request of a counsellor of the Mitchell Library, all dad's scrapbooks and other interesting material were placed in the library, to be kept there for future generations to refer to and study. The National Archives has many descriptions made by my father of horse races and a few fight segments in their safe keeping.

I am hoping to discover further material, written as well as oral, through investigating such sources as your interesting magazine. Any authentic material I am lucky enough to unearth will be placed into the appropriate place.

Louis Angles O'Neill,
16 Awaba St, Mosman 2008.

A Girl Like Alice

You have excelled yourself in your "Lunch With A Girl Like Alice". You managed to make good points, and did it cleverly and kept a smile throughout. Even Alice is going to listen to that.

Raymond Graham,
Launceston 7250.

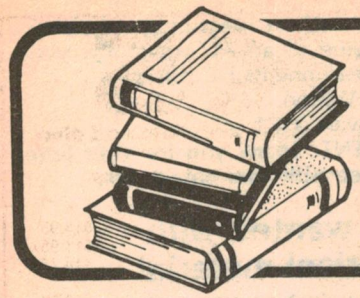
COMMENT: Pardon the blushes and curses on my infernal modesty! WNW.

Computers — here to stay

It makes mad when people keep knocking your magazine because of the content of computers and related projects. With the speed that computers are making an impression on the world why complain? – there is no better way to learn than from experience.

Those interested are going to be one giant step ahead in the near future. As for those not interested, why run down the future when apparently most of you don't even know what you're complaining about!

C. B. Atkins,
Branxton 2335.



Books & Literature

Interfacing to the Commodore PET

PET INTERFACING, By James M. Downey and Steven M. Rogers. Soft covers, 262 pages, 135mm x 216mm, illustrated with photographs and circuit diagrams. Published by Howard W. Sams and Co Inc USA 1981. Price $22.95.

"PET Interfacing" describes the use of the expansion interfaces of the Commodore PET microcomputer and specialised interfaces which can be built for the machine. All the circuits use standard TTL parts, and programs in Basic and assembly language for controlling the interfaces are given throughout the book.

The book is a "how to do it" manual, covering interfacing techniques for each of the three I/O ports. Each example is described with complete software and circuit diagrams. The circuits are suitable for all PETs with the 25 x 40 character video display and the new ROMS.

First example is a breadboarding circuit for the PET's user port, which provides for both parallel and serial data transfer.

Chapter three describes the use of the control signals of the user port and the functioning of the 6522 I/O chip (VIA, or Versatile Interface Adapter). Chapters four, five and six describe another breadboard circuit for use with the memory expansion port of the computer. This port actually brings out all the bus signals of the 6502 microprocessor used by the PET, and is available for expanding the computer system as well as for specialised interfacing experiments.

Chapter seven provides a summary of the preceding information plus further techniques for interfacing high-voltage and/or high current devices to the computer. This section is scanty, with details of high-current drivers and use of comparators and A/D converters, but no mention of opto-isolators. Very little is covered in fact in these three pages.

Chapter eight covers the use of the IEEE-488 bus on the PET, and is perhaps the most useful section. A special interface circuit is described that can be used to control a printer, and a general purpose talker/listener interface is circuit is given for connection of non-IEEE compatible devices to this port. This is done by using another microprocessor to simulate the presence of an IEEE-488 I/O device on the bus. Complete details including assembly language program listings are given in this part.

On the whole, "PET Interfacing" is a patchy book, with some useful and comprehensive sections and some not so good. If you have a special interest in the interface connectors of the PET, particularly the IEEE-488 port, perhaps the somewhat high price would be justified.

Review samples were submitted from McGill's Authorised Newsagency, 187 Elizabeth St, Melbourne, and from Technical Book & Magazine Company Pty Ltd, 289 Swanston St, Melbourne, Victoria. (P.V.)

TRS-80 Assembly

TRS-80 ASSEMBLY LANGUAGE: By Robert S. Howe. Paper covers, 185 pages, 174mm x 235mm, illustrated with charts and diagrams. Published by Prentice-Hall Inc. USA 1981. Price $13.50.

This book grew out of a series of columns by the author in the US publication TRS-80 Monthly News Magazine. This may account for the repetition evident in some parts of the text. This is a minor point; if anything, the occasional redundancies re-inforce key points of the author's discussion of assembly language programming. Overall, this is a very good book – not just for users of the TRS-80, but for anyone with a Z80-based computer.

The index of the book gives an indication of the scope and depth of the text. In 17 chapters the author proceeds from "What is Machine Language" to "Disk Input and Output" and "Disk Files". Five appendices provide tables and lists of the Z80 instruction set, an ASCII to hexadecimal conversion table and a list or reccomended further reading.

"TRS-80 Assembly Language" is divided into three major sections, covering the architecture and instruction set of the Z80 CPU, the organisation of the TRS-80 computer, including the use of ROM subroutines, and practical programming.

The first part of the book defines machine language and discusses the basic components of the TRS-80 computer. Readers looking for explanations of basic terms (like ROM and RAM) will find this section useful for cutting through the jargon. An overview of the Z80 instruction set follows, dividing the various instructions into classes and explaining the uses of each group of operations. A separate chapter is included on the use of the stack in Z80 routines.

Readers who use the TRS-80 will be interested in the chapters covering the organisation of the TRS-80 and the use of ROM subroutines for keyboard, video display, cassette interface and disk I/O operations. A short chapter is also included on the use of the TRS-80 Editor/Assembler program, as well as two chapters describing the use of TRSDOS, the disk operating system.

The practical programming section of the book provides separate chapters on topics such as reading and printing data, and floating-point and BCD arithmetic in assembly language. Other chapters include logical and single-bit operations and the use of machine language subroutines in Basic programs with the USR statement.

All in all the practical programming section of the book comprises 11 chapters, full of useful information for the Z80 assembly language programmer and users of the TRS-80 in particular.

The author's explanations are clearly expressed, and, as is essential in any programming text, each point is illustrated with sample programs. Succeeding chapters build on each other, and the result is a comprehensive treatment of many important areas of assembly language programming.

Our review copy came from McGill's Authorised Newsagency Pty Ltd, 187 Elizabeth St. Melbourne, Vic 3000. (P.V.)

Basic Programs

PRACTICAL BASIC PROGRAMS: Lon Poole (ed). Published by Osborne McGraw-Hill, 1980. Soft covers, 214mm x 276mm, 171 pages. Price $18.00.

The programs in this book are described in the introduction as "programs that do something useful". Forty relatively short programs are provided, covering a wide range of practical applications in the fields of finance, management, statistics, mathematics and science.

No statements peculiar to one particular version of Basic are used in the programs,so they can be run unmodified on the TRS-80,the Apple II and Commodore machines. In addition to the listing of the program the text provides notes on the subject matter and uses of each program, the input required and the output produced, potential applications and notes for program conversions and "tailoring" for special uses.

Of course, the definition of a "practical" program varies with who is doing the defining, and some of these programs may appear of limited use. Mathematicians will be interested in programs for Lagrangian interpolation or for calculating factorials, and some investors may wish to calculate the current value of a US Treasury Bill, but for many these programs will have limited appeal.

On the other hand a useful Home Budget program is included, along with

tips for customising it to the user's requirements. Businessmen can find examples of programs for determining depreciation, economic order and production quantities and others illustrating management techniques such as PERT (Program Evaluation and Review Technique). Students of statistics will also find much to interest them.

A secondary purpose of the book is to "show by example the wide range of subjects that lend themselves to computerisation". Even if the programs presented are not immediately useful parts of them can be used in almost any application. For example, embodied in many of the programs is a function for rounding arithmetic calculations to the nearest cent, and another routine for pausing at the end of each full display screen. At the very least the book is an answer to that perennial question "What do you do with a computer?"

Our review copy came from Dick Smith Electronics Pty Ltd (P.V.)

Books recently received

The 8086 BOOK, includes the 8088, by Russell Rector and George Alexy. Published 1980 by Osborne/McGraw-Hill, Berkeley, California. Soft covers, over 600 pages, 166 x 235mm, illustrated with many diagrams and charts. Price $18.00.

This is a comprehensive survey of the 8086, Intel's first 16-bit microprocessor which is second-sourced by Mostek. Our copy came from Technical Book & Magazine Company Pty Ltd, 289-299 Swanston Street, Melbourne, Victoria.

8085 COOKBOOK, by C. A. & J. A. Titus and D. J. Larsen. Published 1980 by Howard W. Sams & Co., Inc. Soft covers, 350 pages, 135 x 217mm. Illustrated with charts and diagrams. Price $18.95.

As the title suggests, this is a down-to-earth but comprehensive survey of the 8085, Intel's improved version of the 8080 8-bit microprocessor. One of the features of the book is a three-chip microcomputer based on the 8085. Our copy came from McGill's Authorised Newsagency Pty Ltd, 187 Elizabeth Street, Melbourne, Victoria.

PASCAL PROGAMS FOR SCIENTISTS AND ENGINEERS, by Alan R. Miller. Published 1981 by Sybex Inc. Soft covers, 374 pages, 180 x 230mm, illustrated with many program examples. Price $21.00.

A particularly useful book for the reader who is approaching Pascal for the first time. Our copy came from Technical Book & Magazine Company Pty Ltd, Melbourne.

6502 GAMES, by Rodney Zaks. Published 1908 by Sybex Inc. Soft covers, 292 pages, 140 x 216 pages, illustrated with many program examples. Price $17.60.

Rodney Zaks takes his usual light-hearted approach to programming the 6502 with games in mind. Our copy came from McGill's Authorised Newsagency of Melbourne.

New Products...

Product reviews, releases & services

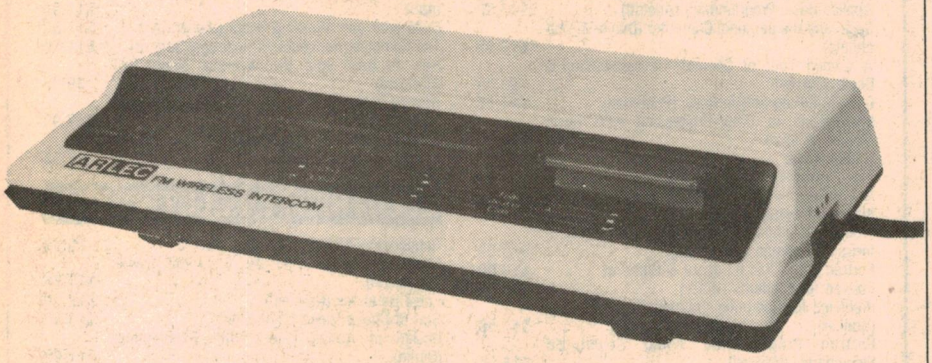
No wiring needed for Arlec intercom

An intercom system can be a very convenient installation in the home or office, but many people have been deterred by the need for long wiring runs and permanent fixtures. A new product from Arlec Pty Ltd solves these problems. Their new intercom system uses the existing mains wiring to transmit FM coded messages. Installation is simply a matter of plugging in to a power point.

Arlec Pty Ltd recently introduced a fully automatic, two channel wireless intercom system for home or office use. The AIC1500 intercom system uses frequency modulated (FM) transmission, making it virtually immune to background noise or interference. It also incorporates automatic sound-activated transmit/receive switching for "hands-off" operation during conversations, and an "anti-deadlock" feature which prevents conflict if both stations are simultaneously set to transmit.

As supplied, the basic intercom system consists of two units. This may be extended to include as many units as required. A channel selector switch is provided which allows selective calling of individual stations in a three or four station network and permits two private conversations to take place simultaneously.

The intercom units are compact and attractively styled, measuring 217mm x 135mm x 40mm. Each station includes power on/off and transmit indicator LEDs, a volume control and a call button for attracting attention at the station being called. A transmit lock switch on the rear of the unit enables it to be used to continuously monitor sounds in the area making the intercom convenient for use as a sick-room monitoring unit.



No wiring is necessary between stations as the units are connected through the electrical wiring of the building they are used in. Plugging the stations into the mains at the chosen points connects them together as well as providing operating power. Not only can the units be operated as soon as they are plugged in, but they can be quickly and easily changed to other locations when necessary.

Long distances can be covered by this connection method, although communication is not possible through a distribution transformer or when the two units are connected to different phases of the mains supply line.

Other uses include communication within the home or between indoors and an outside workshop or toolshed, office intercom systems, in factories, warehouses, shops, surgeries and hospitals etc.

Recommended retail price is around $60 for a pair of the units.

For further information on the Arlec AIC1500 intercom system contact Arlec Pty Ltd, 30 Lexton Rd, Box Hill, Vic. 3128.

Connectors from utilux

A new sub-miniature "D" connector range is available from Utilux Pty Ltd, together with a two circuit "shunt" connector, the series 7859. A shunt connector, or shorting block is often used in place of a DIP switch in hard-wired logic, address decoders and wiring for optional circuit functions.

The new connectors use phosphor bronze contacts on 2.54mm centres.

Utilux Pty Ltd is at 14 Commercial Rd, Kingsgrove, NSW, 2208.

A new range of Kaise multimeters

Standard Components Pty Ltd has announced a new, updated range of Kaise digital autoranging multimeters for 1982.

Designed for both the professional and the hobbyist, all of the new models feature fast autoranging on volts and ohms ranges, simple pushbutton operation and large 3½-digit displays. Accuracy is claimed to be better than 0.8%.

The SK6330 and SK6440 models have 10 amp, 200mA and 20mA AC and DC current ranges. The SK6330 also incorporates a piezo-ceramic buzzer to indicate overload, range change and circuit continuity.

Additional to the new range of digital multimeters is a range of precision analog meters, including 13 instruments for field, laboratory, school and home use. Models are available with light meter and temperature sensing facilities, transistor test functions and capacitance measurement capabilities.

Kaise multimeters have a reputation for reliability and accuracy, and the new expanded range almost guarantees that a meter will be available to meet any requirements.

Further information is available from Standard Components Pty Ltd, 10 Hill St, Leichhardt, NSW, 2040 (PO Box 174, Leichhardt).

Dispenser pack for desoldering braid

From Scope Laboratories comes a handy new "desoldering braid dispenser", claimed to accurately position the braid, even in awkward spots, and to help avoid burnt fingers when desoldering.

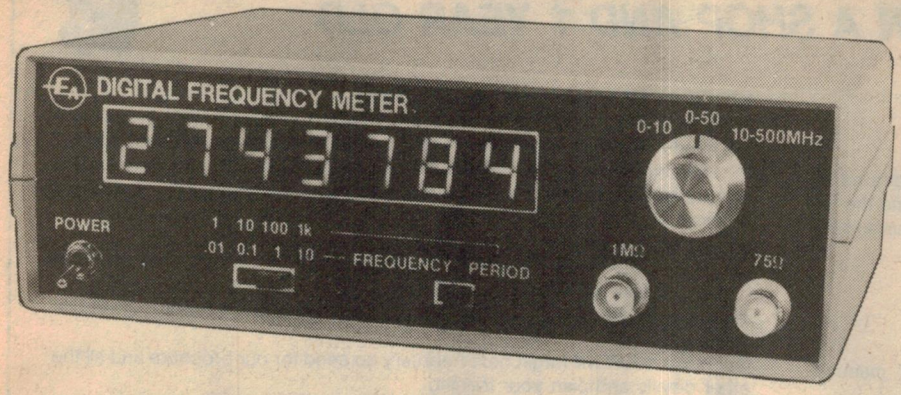
The dispenser pack lets surplus braid be easily rewound, and is said to hold 30% more braid than conventionally packed plastic spools. A metal tip on the dispenser eliminates the need to hold the braid itself close to the work area and the hot soldering iron.

According to scope, the dispenser pack with two metres of braid will be priced competitively with standard spools.

Also available from Scope is a range of wire cutters. Known as "Scope Flushcutters", the range features a scissors type cutting action, rather than the crushing action of other cutting tools. Four flush cutting sidecutters and one pair of long nosed pliers are included in the range.

For further details contact Scope Laboratories, 3 Walton St, Airport West, Vic. 3042.

Price Correction for DFM



Last month's article on our new 500MHz digital frequency meter has created a great deal of interest amongst our readers. It can be built in either of two versions, 50MHz or 500MHz, with a saving of about $25 for the lower frequency version. This is the easiest-to-build frequency meter kit that we have ever produced. Unfortunately though, gremlins attacked one of our advertisers, Electronic Agencies, of 115-117 Parramatta Road, Concord, NSW 2137. Instead of the frequency meter kit being priced at **$119** for the 50MHz version, our gremlins changed it to read $135. Electronic Agencies advise that the all-up price for the 500MHz version is $134. We apologise to Electronic Agencies and to our readers for any inconvenience due to this error.

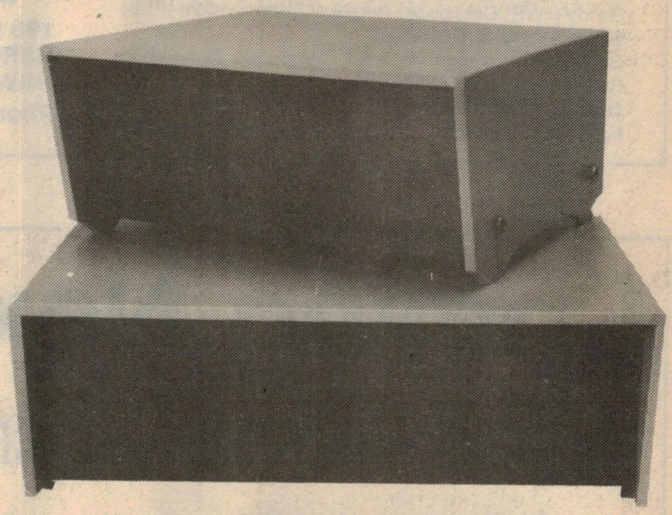
AWA has digital measuring bridge

Amalgamated Wireless (Australasia) Ltd has introduced an automatic digital bridge for measuring inductance, capacitance, resistance and Q factor. The AIM LCR Databridge 401 is an autoranging measuring bridge which provides highly accurate readings of LCR and Q. Two measurement frequencies, 100Hz and 1kHz, are provided and both parallel and series equivalent circuits are available.

Measured values are displayed within one second of the component being plugged in, and are updated twice per second. A four digit LED display feature has automatic decimal point positioning and over and under range indication. Range indication is by nine LEDs showing pF, nF, μF, Ω, kΩ, MΩ, μH, mH and H. All LEDs are blanked to indicate Q measurements.

Further information is available from AWA Ltd, 422 Lane Cove Rd, North Ryde, NSW, 2113.

Plastic cases moulded to order



Individually styled plastic housings for electronic and scientific instrumentation, computers and business machines can now be customed designed and manufactured without the high tooling and die costs normally associated with conventional moulding processes.

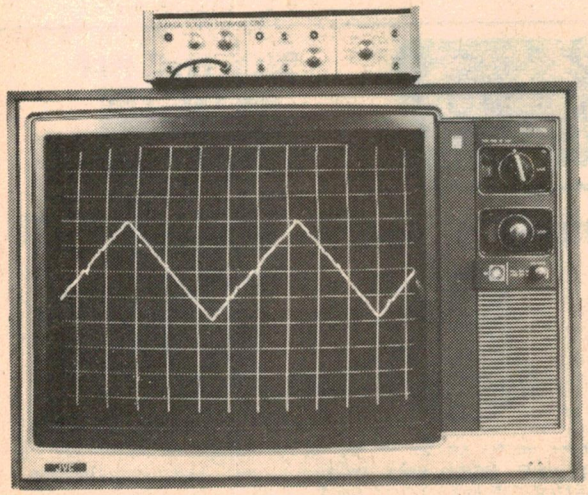
A new service offered by Aegis Pty Ltd of Melbourne, uses vacuum forming and fabrication techniques which afford the designer virtually all the facilities of conventional mouldings, but tooling costs are in the order of only a few hundred dollars as compared to the several thousands of dollars normally envisaged.

The process makes use of versatile ABS plastic sheet, which lends itself readily to forming into a myriad of shapes and styles and in the finished state is lightweight, durable and strong.

Enquiries should be made to Aegis Pty Ltd, 141 Christmas St, Fairfield, Victoria 3078, or to PO Box 49, Thornbury, Vic. 3071.

Coming Next Month ***

Large Screen Storage CRO Adapter



Our new Large Screen Storage CRO Adapter converts a normal black and white or colour TV into a storage CRO with features such as a fully synchronised display, electronic graticule, one shot triggering and storage of up to four separate screen displays. At left, our prototype displays a 6kHz triangle wave.

REVIEWS:

Tandy's new
COLOUR COMPUTER

It is now possible to produce colour graphics easily with a home computer. Read about Tandy's BASIC statements such as LINE, CIRCLE and PAINT in our comprehensive review.

ON SALE:

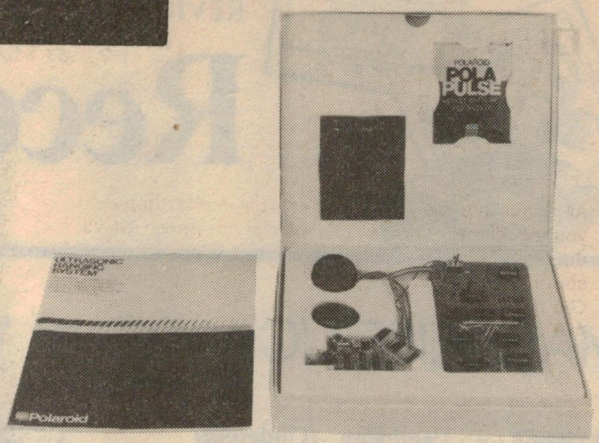
Wednesday February 2nd

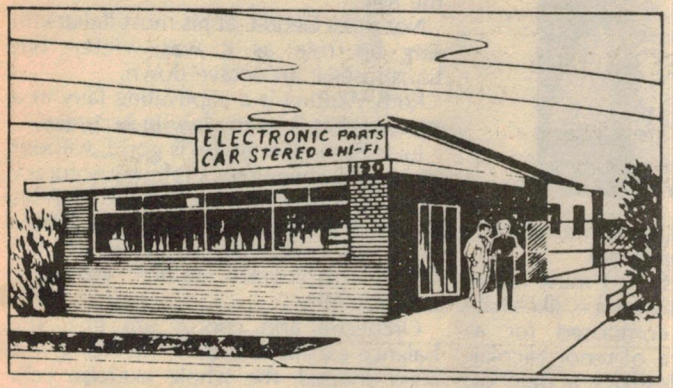
*Our planning for this issue is well advanced but circumstances may change the final content. However, we will make every attempt to include the articles mentioned here.

New Products

Ultrasonic ranging experimenters kit

In our November 1981 issue we described the Polaroid System 660 camera, which uses an ultrasonic ranging device to focus automatically and to adjust the operation of the flash unit. Polaroid Australia Pty Ltd has now released a complete ultrasonic ranging system designer's kit, intended for manufacturers and hobbyists who wish to conduct tests and experiments with the unique ultrasonic system. The kit includes two ultrasonic transducers, an ultrasonic generator board and a demonstration board containing the ranging circuitry and display. Also included are two 6V "Polapulse" flat batteries, all cables and connectors and a detailed applications manual. For more information contact Polaroid Australia Pty Ltd, 3 Eden Park Estate, 31 Waterloo Rd, North Ryde, NSW, 2113.





G.I.S. Electronics opens in Punchbowl

A new electronics store has opened in Punchbowl. Trading as G.I.S. Electronics, the store is a joint venture between Pre-Pak Electronics Pty Ltd and Mr Stan Woolley, the manager of the store.

Situated at 1190 Canterbury Rd, Punchbowl, the shop is handy to Roselands shopping complex. A full range of electronics components, hifi equipment and car radios are stocked, and in addition there will be "special buys" of Pre-Pak products each month. Parking is available on the premises.

G.I.S. plans extensive renovations of the store, which will not be fully completed until next year. In the meantime we have published an artist's impression of the new shop at left. Pre-Pak Electronics Pty Ltd is at 1A West St, Lewisham, NSW, 2049.

IC insertion tools — OK for CMOS

A new IC Insertion/Extraction tool kit made by OK Machine & Tool Corporation is now available from Radio Despatch Service. Included in the kit are insertion tools for 16-pin, 24-pin and 40-pin integrated circuits, and two IC extraction tools. One insertion tool incorporates slots for straightening IC pins.

We have been using the OK kit in our laboratory for some time now, and can report that the tools work well, although the "pull up" operation of some of the insertion tools takes a little getting used to at first. In particular, handling of 40-pin chips is much simplified by the tools.

Also available from Radio Despatch Service is the Weller temperature controlled soldering station. The station includes a soldering iron stand, a holder for a tip cleaning sponge and a lightweight iron which can be accurately adjusted to temperatures from 50°C to 450°C in 50° increments. An illuminated off/on rocket rocker switch and a LED temperature indicator complete the unit.

More information is available from Radio Despatch Service, 869 George St, Sydney, NSW, 2000.

New range of high speed logic chips

Soanar Pty Ltd has available a new Motorola CMOS digital logic series of chips. The MC74HCXX "High Speed Logic" family offers the speed and performance of LS TTL circuits combined with the low power consumption and high noise immunity of CMOS. Each chip is pin compatible with its TTL equipment, and the series is rated to 30MHz with full 4mA LS TTL drive capability.

Further information is available from Soanar Electronics Pty Ltd, 30 Lexton Rd, Box Hill, Vic. 3128.

REVIEWS OF RECENT

Records & Tapes

CLASSICAL • POPULAR • SPECIAL INTEREST

MASSENET/Cendrillon: "Sheer enchantment"

MASSENET — Cendrillon (Cinderella) complete opera. Frederica von Stade (Cendrillon); Nicolai Gedda (Prince); Jane Berbie (Madame de la Haltiere); Jules Bastin (Pandolfe); Ruth Welting (The Fairy); and others with the Philharmonia Orchestra and the Ambrosian Opera Chorus conducted by Julius D. Rudel. CBS Masterworks Stereo (three Discs) 79323.

As in all his early works, there are many musical prophecies and many snatches of previous composers' works in Massenet's delightful opera Cendrillon (Cinderella).

Not so long ago, Massenet was disparaged by the musical illuminati as a purveyor of syrupy sentimental tunes, along with unadventurous orchestration, a lack of dramatic sense in his operas and for many other sins diligently sought by the Central European School.

Today, more enlightened opinion has changed and Massenet is remembered gratefully as an operatic composer with great gifts, a user of deft and original orchestration, a fine sense of character and drama and, above all, as an inspired teacher.

In this opera you will hear bars reminiscent of Rossini and others but also Massenet's very individual style.

It was originally composed for one act but was later expanded into two by the composer, much to his admirers' content.

It bears little resemblance to the Rossini, because Massenet used the Perrault (French) version which concentrates much more on the fairy element of the tale. It has long since dropped out of the standard operatic repertoire — except in France, not unexpectedly! But it is an opera of the greatest imaginable refinement, with a delicious fairy-like character providing an evening of sheer enchantment.

Much of the success of this recording is due to the conductor Julius Rudel, whom I am meeting here for the first time. His control of his forces is firm but always sensitive to the fragile romanticism and delicacies of the score. To all these he is capable of adding passion of the volupte type whenever it is necessary.

While writing of passion I must mention that the role of the prince, like that of Cinderella, was composed for a soprano. The use here of tenor Nicolai Gedda in the role destroys a deal of Massenet's carefully considered effects, especially as the Cinderella is sung with such consistent beauty of tone and phrasing by Frederica von Stade, urged by Rudel to perform miracles with a voice naturally a bit on the heavy side for the role.

Nor does Gedda, at his most Italianate, sing his role as it was written but transposes it an octave down.

Ruth Watting is a captivating fairy in a reading that is exemplary in accuracy.

Jules Bastin (Pandolfe) is good, without always shadowing Ms Welting's accuracy of pitch, a fault he never disclosed in his fine performance of Herod in L'Enfance du Christ conducted by Davis. All the other principals make valuable contributions.

Orchestra and chorus are fine, the balance excellent and the recording first class. Indeed, the whole exercise yells for more live performances in Australia. (J.R.)

PUCCINI/Le Villi
"Very impressive indeed"

PUCCINI — Le Villi. Complete opera. Rehata Scotto (Anna); Placido Domingo (Roberto); Leo Nucci (Wolf) and Tito Gobbi (narrator), with the National Philharmonic Orchestra and Ambrosian Opera Chorus conducted by Lorin Maazel. CBS Stereo Masterworks (one disc) 76890.

Another early opera, this time a first, by Puccini. It shows many of the same prophecies of things to come later and scraps of other composers' influences as the Rossini.

It is based on much the same story as the ballet Giselle and was called by the composer a ballet-opera because of the great amount of dancing in it. It dropped out of the standard opera repertoire for many years, indeed ever since its first unenthusiastic reception. However, it was gallantly revived at the last Adelaide Festival.

Originally written in one act, Puccini later expanded it to two, which is the version recorded here. Despite other influences, the Puccini-to-be occurs often enough to stamp the work with his own formidable identity.

Although in two acts it is a short work but Maazel's conducting of the performance seems somehow to lend it additional weight. In this he is aided by a cast that is very impressive indeed. Importantly, Maazel uses them discreetly so that they characterise their parts well without melodramatic exaggerations in a very melodramatic story.

The same goes for the orchestra which has some very awkward syncopations to accent cleanly in some of the dance music. I must add, however, that there are moments when you might be excused for thinking you are listening to

Reviews in this section are by Julian Russell (J.R.), Paul Frolich (P.F.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

Cavalerria Rusticano. Scotto gives one of the best performances I have heard from her in recent years and the air of tiredness that was developing around the opera has fallen away.

Domingo, rich and surely pitched, and suitably restrained from Italian self-indulgence is also fine; a keen ear will already detect some hint of Manon Lescaut which was not far away in the future. Another to avoid self-indulgent melodrama is Nucci as the hero's father. And you have the additional enjoyment of hearing Tito Gobbo speaking some verses in a voice that reminds us of his wonderful singing career.

I cannot close this criticism without special mention of the excellent work of the Ambrosian Opera Chorus and a recording that has plenty of space and good presence. (J.R.)

"PICTURES": Digital plus eccentricities

MUSSORGSKY – Pictures at an Exhibition. (Ravel Orchestration.) Concertgebouw Orchestra conducted by Sir Colin Davis. Philips Digital Stereo Disc 9500 744.

The Concertgebouw sound is a bit less weighty under Davis than under their resident conductor Bernard Haitink. And this is not the only unusual feature of this digitally recorded disc.

In his interpretation Davis displays some odd eccentricities. His playing of some of the many pieces that comprise the work is indeed his own, his tempos being sometimes unusually slow, although they never seem to loaf. I refer in particular to the Promenade theme often heard and used by the composer to bind his graphic little pieces together. The idea was to follow a visitor to an art show from picture to picture.

For instance, there is a slight hesitation about the first – or introductory – Promenade that might well give the listener the idea that "customer" is making up his mind whether to go in or not. This, of course is my own subjective reaction, although it might well have been Davis' intention.

In drawing attention to the sometimes odd things that follow, I have no intention of disparaging either the performance or the recording. Both are first class. Ravel's inspired orchestration of these pictures, originally written for piano solo, is done full justice in its clarity and impact. If the Concertgebouw's usual warmer, firmer sound is occasionally absent, Davis substitutes a quite acceptible alternative.

The first picture, Gnomes, could, for my taste, hint at a little more distortion among the little people it displays. But, despite this "tightness", if you listen closely, you will hear much detail that you may have missed in previous recordings.

In the second Promenade the visitor obviously doesn't show much eagerness to proceed to the next picture, The Old Castle. Here, the slow tempo seems to add decrepitude to its age. It suggests that it might just have suffered desolation by defeat.

However, a bright trumpet call summons the viewer to the next canvas, Children Playing in the Tuileries Garden. This is deliciously played, little squabbles and complaints being most realistically re-created.

"An undiluted joy in its delicacy and point"

Next comes a Polish Ox Cart, not particularly heavily loaded on this occasion and exemplifying the lightness of the orchestra mentioned above.

Another Promenade still not very enthusiastic, although full of detail and other beautiful sounds, introduces a Ballet of Unhatched Chickens, an undiluted joy in its delicacy and point.

We next meet two Mews, one rich, the other poor, the latter obviously begging a favour of the first. The rich one is magnificent in his denials, the poor one more and more importunate. There is no doubt about the final refusal.

Catacombs combines threat with mystery and, in the middle portion, lament.

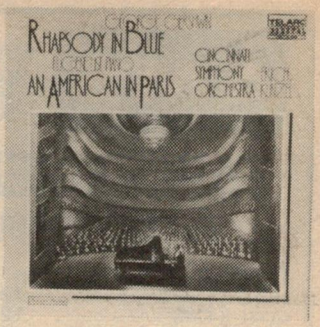
And the next Promenade suggests that, when the viewer departs, it is almost with an air of unease. The Hut on Fowl's legs paints a picture of a fabled Russian witch, in this case a very mild and sly one.

Lastly we have the Great Gate of Kieff, a magnificent chorale that successfully survives some oddities of balance. There is much – too much – bass drum and here the brightness of the orchestra shows up again the uproar of the brass and bell.

This may not be your favourite performance of the Pictures but it is one that must be treated with respect.

The fill is A Night on the Bare Mountain, weightier in tone than the pictures. The Bare Mountain is very picturesque although not very frightening. It occurs to me that the lack of weight in the Concertgebouw might be due to the excellently clear recording and the complete lack of sonic congestion. But it was one of Philips' earliest digitally recorded masters – one reason why I have given it so much space. (J.R.)

RHAPSODY IN BLUE
"Tuneful, musical spectacle"



RHAPSODY IN BLUE. AN AMERICAN IN PARIS. George Gershwin. Eugene List, Piano. The Cincinatti Symphony Orchestra conducted by Erich Kunzel. Telarc stereo digital DG-10058. (From P.C. Stereo, PO Box 272, Mt Gravatt, Qld 4122. Phone 07 343 1612.)

A review of this new recording in "Billboard" praises Erich Kunzel for stripping away hackneyed phrasings and tired symphonic jazz cliches. Pianist Eugene List is credited with a fresh and spellbinding performance and a sense of new discovery to each phrase of the famous "Rhapsody".

But Kenneth Dommet, in the British "HiFi News and Record Review" rates neither performance nor recording in any way outstanding and, at the price, poor value for 34 minutes of music that is heard better elsewhere. The pianist is "unduly circumspect", the conductor contributes little new light and the orchestra seems "unrelaxed"!

While beauty, in this case, may well be in the ear of the beholder, I couldn't help but wonder whether Kenneth Dommet's reservations might be traceable to a cartridge which wasn't quite equal to the task of tracking this particular Telarc digital – because it does make very considerable demands in terms of dynamic range and peak amplitude. And I doubt that your speakers will ever be asked to reproduce bigger drum beats.

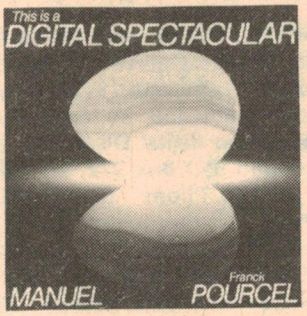
I can understand why some may question the price on a per-minute basis and why others may prefer versions by other pianists and other orchestras, but I certainly didn't share Kenneth Dommet's other reservations.

On the contrary, I can see this album becoming very popular with audiophiles who might enjoy a bit of spectacle a-la-Telarc. The sound is clean, the surface is good, and the dynamic range all that can be accommodated in an average home. But you do need good equipment to do it justice.

I've said nothing about the composer, the music, the artist. If you buy the album, in its handsome double-fold jacket, you'll find it all there on the back and the centre spread.

There's obviously room for widely differing reactions to performances of these popular items but as I said earlier, if you're partial to some tuneful musical spectacle a-la-Telarc, you could be putting this one on the turntable quite a bit. (W.N.W.)

RECORDS & TAPES — continued



THIS IS A DIGITAL SPECTACULAR — Manuel, Frank Pourcel and the National Philharmonic Orchestra. Stereo, EMI Records, EMC-2732.

In an era when digitally-sourced records are so much in the news, it takes a brave producer to brand his album "Digital Spectacular". But that's what Claude-Michel Schoenberg has done, with the apparent endorsement of John Borwick, Audio Editor of "Gramophone" magazine.

Side 1 (Manuel) is at a somewhat more popular level and features an unnamed orchestra supported by a wordless vocal chorus. The tracks: Bolero – Adagio In G Minor (Albinoni) – To Be With You (from the film "Gloria") – Eclipse – Interlude (Khromushin) – Bright Eyes (from the film "Watership Down").

Side 2, Frank Pourcel and the National Philharmonic Orchestra, has: The Great Gate Of Kiev (Moussorgsky) – Gymnopedia No. 1 (Satie) – Sicilienne (Bach) – Norwegian Dance No. 2 (Grieg) – Sicilian Vespers (Verdi) – Gymnopedie No. 3 (Satie).

Side 1 is quite pleasant and clean but side 2 can lay much stronger claim to the description "Spectacular". Turn the gain up a bit and your system will get a thorough work-out! (W.N.W.).

☆ ☆ ☆

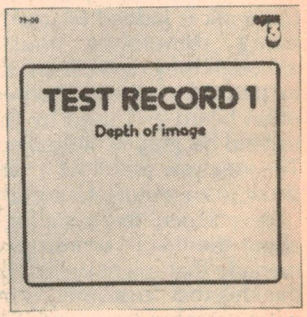
THIS IS WALES, "An album of Welsh Magic". Stereo, EMI SCA-051.

In an album with this title, one would expect to find a complete program of Welsh male choral items. Perhaps appreciating the risk of making a clone of what has gone before, the producers of this disc have sought, rather, to create the atmosphere of a Welsh concert. So, while it has been put together from various sources, the items follow one another closely and audience response has been retained, in some cases, to enhance the illusion.

What you get is about 10 items by male choirs, about three by mixed choirs, two or three solos, and as many brief monologues with strong ethnic background.

And this is really the key to the album. While it contains such universally popular items as "March Of The Men Of

Wide variety of sound



TEST RECORD 1. Depth of Image. Stereo, Opus 3 79-00. From M. R. Acoustics, PO Box 165, Annerley, Qld 4103. Phone (07) 48 7598.

Having specifically praised a couple of Opus 3 albums recently, it came as no surprise to find that this test and demonstration record was no less commendable.

Behind the Swedish Opus 3 label are two recording enthusiasts, Eric Persson and Bo Hansson. Theirs is a "purist" approach, concentrated on acoustic instruments, single stereo microphone, natural ambience, avoidance of electronic "fiddling" and small but talented groups who would seldom attract the attention of the major recording companies.

Add to this TLC (tender loving care) in the production of masters and pressings, and you have Opus 3.

On this album are 16 tracks, in part selected from their library of tapes, in part specially put down for the purpose.

Without seeking to list them all, the tracks feature acoustic guitars in various combinations, brass instruments, a symphonic band, a jazz group, South American Pan Pipes, soprano recorder, pipe organ, bells, cello, choir, solo vocal, and so on. Each track is identified and an explanation given of the kind of sound and what to listen for.

While the items are diverse and relatively short, the whole presentation is both interesting and highly listenable and an excellent demonstration record, intended to inform rather than superficially impress.

No, the mastering isn't digital and the technology carries no fancy names. It is just basically good – very good. Indeed, it's a most impressive demonstration of what can be achieved by conventional analog technology – provided you get it right.

Recommended. (W.N.W.)

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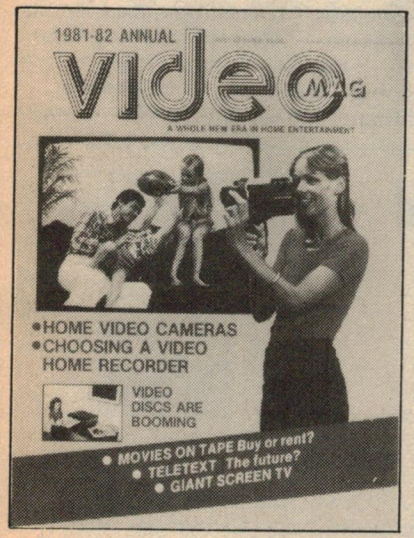

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An "Electronics Australia" publication

Harlech", "Ar Hyd Y Nos" (All Through The Night), "Cwm Rhondda" (Guide Me, Oh Thou Great Jehovah) its strongest appeal will be to those having an empathy with Wales and its traditions.

The sound quality is up to normal standards. (W.N.W.)

☆ ☆ ☆

MAGIC MAN. Herb Alpert. A & M Records L37615. Festival release.

Herb Alpert's latest album, Magic Man, is predominantly instrumental music. However he sings on one track.

He may well be remembered for recording "This Guy's In Love With You" and for Herb Alpert and the Tijuana Brass.

Nowadays, his music is more up-tempo but still rememberable.

The eight tracks on the album are: Magic Man – Manhattan Melody – I Get It From You – Secret Garden – Besame Mucho – This One's For Me – Fantasy Island – You Smile, The Song Begins.

All in all, an extremely well produced and recorded album with haunting melodies. (D.H.)

☆ ☆ ☆

DECADE OF JAZZ. Vol 1 1939-1949. World Record Club R 08684-5.

This double album from The World Record Club should give jazz buffs plenty to enjoy, with its twenty-one tracks, originally released on the "Blue Note" label.

But do not expect to hear tracks that have been cleaned up, enhanced or subjected to any other attempt to lessen the noise level on some of the old original 78s. However, if you like the artists and the music they play, that is a small price to pay.

A sampling of the tracks: Boogie Woogie Stomp (Albert Ammons) – The Father's Getaway (Earl Hines) – Honky Tonk Train Blues (Meade Lux Lewis) – Mule Walk (James P. Johnson) – Maple Leaf Rag (Art Rhodes Chicagoans) – Limehouse Blues (Benny Morton's all Stars) – Round About Midnight (Thelonius Monk Quintet) – Tin Tin Deo (James Moody And His Bop Men).

The sleeve notes provide a background to the origin of the Blue Note jazz label and the people responsible for its foundation. (N.J.M.).

☆ ☆ ☆

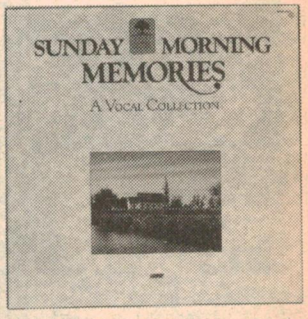
ARTIE SHAW — Recreates his great "38" Band. Capitol VMP1100. EMI Release.

Speaking as one who was brought up on a steady diet of 78rpm discs of band music, such as played in this exciting release, it is fascinating to compare the sounds, with 43 years of recording technology between.

Apart from Shaw, there is only Bernie Privin from the original band on this record. But, according to the sleeve notes, Artie Shaw claims it would be almost impossible to pick the difference in playing styles – and I would agree.

The 13 titles are: Traffic Jam – Begin The Beguine – Lover Come Back To Me – Zigeumer – What Is This Thing Called Love – It Had To Be You – Softly As In A Morning Sunrise – Octoroon – Nightmare – Back Bay Shuffle – Jungle

Yesterday's Gospel Sound



SUNDAY MORNING CLASSICS. A Vocal Collection. Stereo, Word WSB-8855. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135.)

Unless my memory is playing tricks, all the tracks on this album have been picked up from earlier Word releases – some of them much earlier. But it says a lot for Word engineering that the sound is well up to normal technical standards.

It would seem fairly obvious that the album has been compiled for listeners who are less than enamoured by the mod Gospel sound, and who prefer something more traditional. Well here are the titles and the artists involved:

The Old Rugged Cross (Jerome Hines) – I Thank You For Your Goodness (Melody Four Quartet) – The Angels Watchin' Over Me (J. T. Adams) – Church In The Wildwood (Norma Zimmer and Jim Roberts) – My Heavenly Father Watches Over Me (Jack Holcomb) – Sun Of My Soul (Frank Boggs) – Overshadowed (Ralph Carmichael Singers) – This Little Light Of Mine (Dale Evans) – Fill My Cup, Lord (Bill Mann) – In The Garden (Revivaltime Choir) – Beyond The Sunset (The White Sisters) – At The Cross (Burl Ives and The Korean Children's Choir).

Yes, the style is dated in some cases and, in others, the soloists are rather more concerned with effect than pitch. But I suspect that these traits might pass unnoticed by those who are interested primarily in the music of another decade. (W.N.W.)

ORCHESTRAL PRELUDE (by another name)

EXCALIBUR — Music from the film and other selections. Stereo, Island Records (Festival) L-37645.

At first glance, this looks just like another album of film music but closer inspection reveals that the excerpts are not directly from the soundtrack and not necessarily included in the film. Indeed, they turn out to be quite substantive, classically derived items presented by the London Philharmonic Orchestra and the New Philharmonia Orchestra and Chorus. Conductors are Sir Adrian Boult, and Rafael Fruhbeck De Burgos (for "Carmina Burana").

Presumably Island Records felt that the album would do better identified with "Excalibur" than as a clutch of orchestral preludes. The tracks:

Siegfried's Funeral March From "Gotterdammerung" (Richard Wagner); O Fortuna From "Carmina Burana" (Carl Orff); Prelude "Tristan And Isolde" (Richard Wagner); Prelude, Act III "Lohengrin" (Richard Wagner); Prelude, Act I "Parsifal" (Richard Wagner); Reprise O Fortuna From "Carmina Burana"; Ride Of The Valkyries (Prelude to Act III "Die Walkure") (Richard Wagner).

The performances are as you'd expect from the LPO and NPO, and the quality of the recording itself is right up to standard. In short, if you're in the market for classically based orchestral items, this one is well worth considering. (W.N.W.)

Drums — Copenhagen.

An authentic re-creation like this is interesting, because it recaptures the true sound of the old bands, unspoiled by the limitations of the then-available recording techniques. (N.J.M.)

☆ ☆ ☆

MEMORIES OF "BANDWAGGON", "HAPPIDROME" — and other great wireless comedy shows. Mono, World Record Club R-09056.

Although names like Arthur Askey, Richard Murdoch, Jack Warner and others were well known to Australian listeners during the late '30s and early '40s, they had nothing like the exposure here that they enjoyed in Britain. The nostalgic appeal of this album will be tempered accordingly.

Tracks one to six on side 1 are taken from the BBC's "Bandwaggon" broadcasts in 1939. Included is the classical sketch "Playing the organ".

That is followed by a couple of Tommy Handley tracks: "It's That Man Again" and "Tomsky, The Great Counter Spy".

On side 2, there are six tracks from "Happidrome", four of them recorded in 1941, in the Grand Theatre, Blackpool, with Bunty Meadows. Two tracks from Jack Warner round out the collection: "Little Gel" and "What! The old blue pencil".

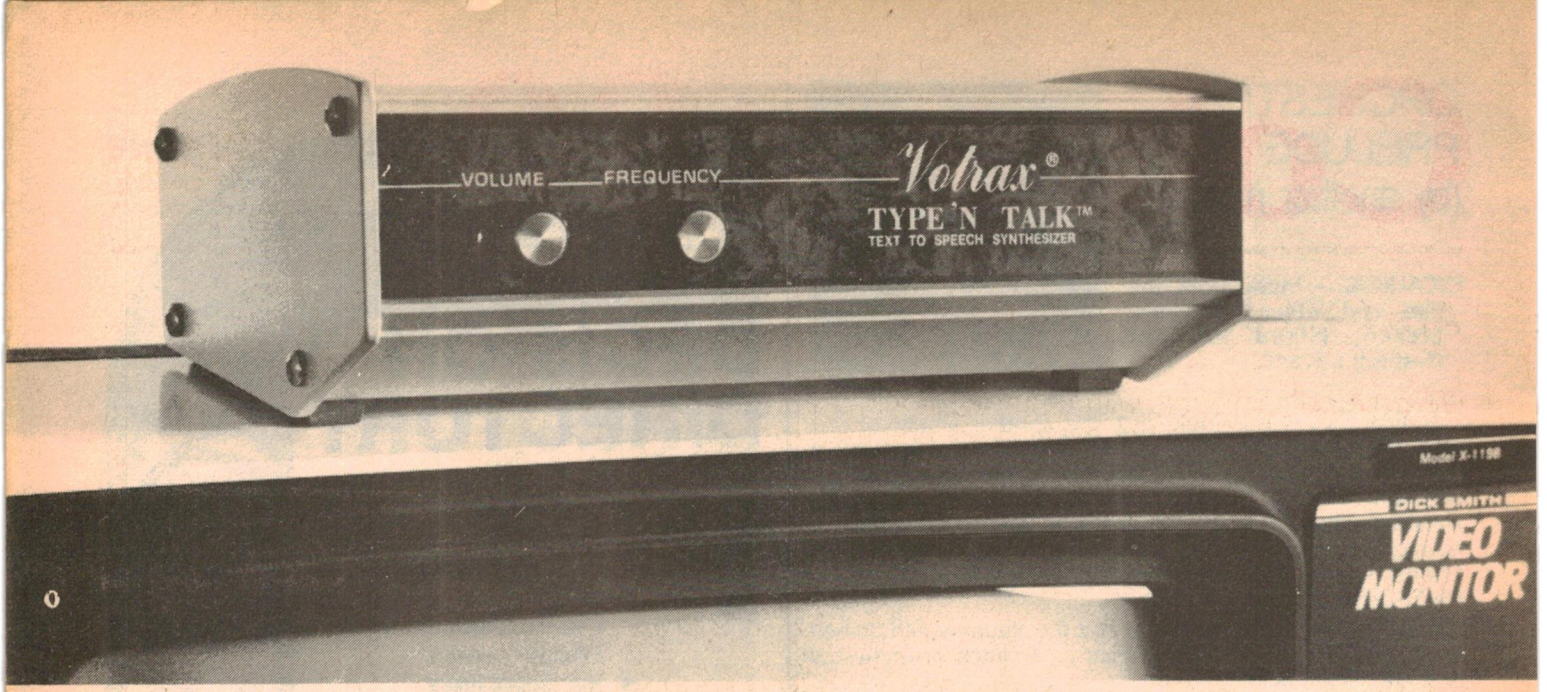
It's not a scream but it is good for a few giggles and it has potential nostalgic appeal if you lived through that era, particularly in the UK. (W.N.W.)

☆ ☆ ☆

GILBERT & SULLIVAN, The Very Best Of. Morriston Orpheus Choir, HM Royal Marines Band. World Record Club 06038.

Already mentioned in an earlier issue, this WRC album contains nearly 40 titles from The Mikado, Pirates of Penzance, The Gondoliers, Iolanthe and HMS Pinafore.

The combination of a male choir and a big brass band may be a bit unusual for the music but it serves to emphasise the "Britishness" of the source and it makes good listening anyway. A nice present for the right listener! (NJM).



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DSE/A122/LM

Column 80

by JAMIESON ROWE
Technical Director, Dick Smith Electronics

Are 8-bit processors on the way out?

Will personal computers with 8-bit processors shortly be superseded by those with 16-bit or even 32-bit processors? I'm asked this question so often that I thought it would make a good topic for this month's column.

Are 8-bit processors on the way out? I'm almost never asked this question by people who have little or no knowledge of computers – presumably because they either don't know that there are any alternative types of processor, or they are much more interested in what a computer will *do* than in the specific hardware inside it. As it happens, I think these people have the right idea – arguments over the relative merits of 8-bit, 16-bit and 32-bit processors often become little more than exercises in theoretical nit-picking, of little relevance to applications in the real world. Perhaps it's significant that the people who ask the question are usually students or hobbyists, with little interest in putting a computer to serious use.

First of all, I'd like to make the point that in many modern computer applications, where you have a single human user communicating with the machine via a keyboard and screen, even a computer with an 8-bit processor is "coasting". The processor spends most of its time "twiddling its thumbs", waiting for the user to respond. In this sort of situation, there is no real point in replacing the processor with one handling 16 or 32 bits – there would be no advantage. In fact, from the user point of view, you couldn't tell the difference.

And I would claim that this situation applies to just about all of the applications of small computers in the home, the school and in small businesses. Whether you're using the machine as a word processor, to maintain and print out your mailing lists, to look after your stock inventory, or to prepare invoices and credit notes, current machines using 8-bit processors are more than adequate for the task. Because it's primarily the operator who determines the operating speed, a 16- or 32-bit processor would offer no significant advantage.

Another point which should be made is that when we describe current processors like the Z-80 as being "8-bit" devices, this is a label of convenience. You can easily be mislead if you take the description too literally.

In fact, processors like the Z-80 are described as "8-bit" because they handle data and instructions in 8-bit chunks, or bytes. But inside the processor, both data and instruction numbers are often re-assembled into larger words, and handled or interpreted as such. Hence in the Z-80 there are a lot of instructions which are effectively 16 or 24 bits in length (i.e., two or three bytes), while a considerable proportion of instructions deal with data words of 16 bits.

The funny thing is that some of the newer "16-bit" processors use the same scheme – both data and instructions are fed into and out of the processor in 8-bit chunks. Often the only difference is that a few more bits are provided on the address bus (so that more memory can be directly addressed), and a higher proportion of instructions deal with data words 16 bits wide. So that to a certain extent, the distinction between "8-bit" and "16-bit" processors is a somewhat arbitrary one.

Another point is that compared with some of the established 8-bit processors like the Z-80, most of the newer 16-bit and 32-bit processors have very little in the way of available support software. And a computer without software is rather like a gramophone without records – not much use at all. So to a certain extent, a computer using one of the newer 16-bit processors tends to be a little like a gramophone for the new digital audio records – capable of exceptionally high performance, if only one had the records to play on it!

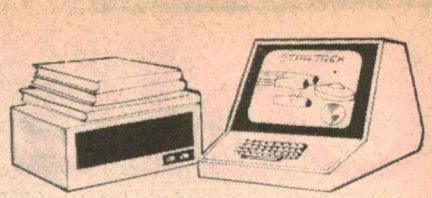
Of course time will change this situation, as more and more software will gradually become available for the 16-bit and 32-bit machines. Similarly, time and market forces will alter some of the other factors also. For example, the price of 16-bit processor chips will gradually fall, if they follow the same course as other ICs, so that it will sooner or later become just as cheap to use a 16-bit or 32-bit processor as to use one of "only" 8 bits.

So I suppose what I'm saying is this: while 16-bit and 32-bit processors will inevitably supersede current 8-bit processors sooner or later, it will probably take quite a while. Partly because there's just so much tried and proven software for the current 8-bit machines, and partly because for a lot of day-to-day applications, the "more powerful" processors just don't offer any real advantage.

Already, it's fairly true to say that for a great many computer applications, it really doeesn't matter what processor chip is inside the machine – the user is really dealing with a system whose main effective component is the software. And as far as I can see, this is going to become even more so in the future. Before long, it won't be of the slightest practical interest to anyone as to what particular hardware is inside the machine – let alone how many bits it is shuffling around at a time.

So if you take my advice, you won't be worrying too much about whether your 8-bit computer may become obsolete. It probably won't do so for some time yet, and in any case you'll still be able to use it even after it has been technically superseded. In fact for quite a while after this happens, neither you nor anyone else is likely to be able to tell the difference!

Microcomputer News & Products



System-80 expansion interface and disk drives tested

Recently we had a chance to try out the S-100 expansion interface for the System-80 computer. With the addition of a disk drive and Disk Operating System (of which more later) the System-80 plus expansion unit forms a very powerful set-up for the businessman or the hobbyist with big plans.

The Mk II System-80 is specially designed for business use. It is shown here with the expansion interface and a pair of Percom disk drives.

Physically the expansion unit is an attractive addition to the System-80. Measuring 415mm x 230mm x 100mm (W x H x D) and moulded in white and black ABS plastic, the unit is designed to sit behind the computer console, and is connected to the computer's expansion port by a 16cm length of 50-way parallel cable. A video monitor sitting on top of the unit is thereby raised to a convenient height for comfortable viewing.

Additional connectors on the front of the expansion unit provide for connection of from one to four 133mm floppy disk drives and a Centronics-type parallel printer. A clip-on plastic shield covers these connectors, preventing them from being accidentally dislodged. At the right hand side of the unit is a 25-way D-type connector for the RS-232C serial interface, power supply, fuse-holder and power switch.

Internally the expansion unit is well laid out, with very little waste space. Mounted horizontally near the top of the unit is the board which provides the interfacing logic to the S-100 bus, the parallel and serial interfaces and the floppy disk controller. Except for the serial port, connections are made directly to edge connectors on this board. Beneath the main board are two edge connectors for S-100 boards, which are also mounted horizontally. In the system we reviewed, the bottom slot contained a 16K S-100 RAM board, (Cat no. 4016 from DSE) providing a total of 32K of memory for the computer. This board has sockets fitted for an additional 16K of memory, for a total of 32K in the expansion interface and 16K in the System-80 console.

Our only reservation concerning the design of the expansion unit is that the power supply seems to run quite hot, while provisions for ventilation are not extensive. We encountered no problems in using the unit, but with both S-100 slots in use things could become warm, particularly as there is no provision for mounting a cooling fan.

With the expansion interface we used a Percom Mini Disk drive from Dick Smith Electronics. The drive is packaged in a white metal cabinet measuring 150mm x 305mm x 85mm (W x D x H) and includes a built-in power supply. Connection to the expansion unit is by way of a parallel cable which allows up to four drives to be "daisy-chained".

The Percom drives provide 40 tracks of 10 sectors each on a standard 133mm soft-sectored diskette. Each sector can hold 256 bytes of data when the disk is formatted, so total storage on a single side of a diskette is around 102K bytes – very respectable indeed. Track to track stepping time is 20ms. As with all small floppy disk drives, data transfer rate is 125K bytes/second. For a program of average length, the disk drive will spend the greatest proportion of the time stepping from one track to another, rather than actually reading or writing data. The stepping time of the drive therefore is a significant factor in determining the speed of disk accesses.

A disk system is no use without software of course, so we combined our drive with the OS/80 Disk Operating System (DOS), also by Percom. This DOS has been specially designed for ease of use, and while not offering some of the advanced features of other operating systems, it is ideal for business and hobbyist use as an adjunct to Basic programs. It is also very versatile and easy to customise to the user's own requirements.

OS/80 is a relatively simple disk operating system. Written in machine language, it occupies about 7K of RAM (about 7% of a single disk). Once the operating system is loaded into the computer's memory (by a power on or Reset) it does not need to access the disk again, unlike many other operating systems which are loaded into memory section by section as needed. This means that you can boot up the DOS then remove the system disk from the drive and replace it with a disk of data or programs. It is thus feasible to use OS/80 with a 16K, single disk drive system.

Again, unlike other Disk Operating Systems, OS/80 operates in conjunction with Basic rather than as a separate entity. In itself it offers the minimal commands needed to access data by specifying a drive number and a sector or sectors to be accessed. All other facilities, such as file handling and directory organisation must be taken care of by Basic programs.

This could be tedious except for the fact that the system diskette provides four Basic programs as examples of what to do and how to do it. The first of these is a simple disk file management program which allows a directory to be created and updated for up to 50 files

Micronews continued ►

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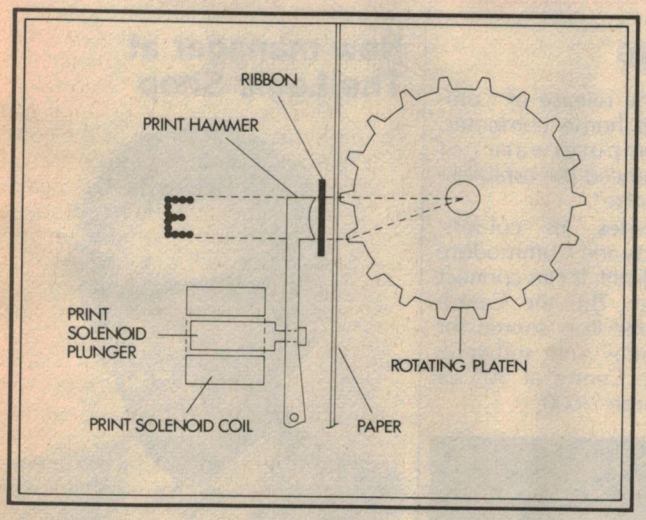

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It took a company such as the Seiko group, world's largest watch manufacturer, with vast experience in the design of small, intricate, precision products, to come up with a totally new concept in dot matrix printing.

How the Uni-Hammer Works

The X-3252, which prints both graphics and alphanumerics, uses a rotating platen with protruding splines positioned behind the paper (see diagram). The character or graphics image is created by multiple hammer strikes in rapid succession as the print head advances across the paper. The precision gear train assures exact positioning of the print hammer relative to the splines on the platen, to provide excellent print quality.

A Complete Printer

The X-3252 has features comparable to printers selling for thousands of dollars. These include upper/lower ASCII character sets, ribbon cartridge, 80 columns at 12 characters per inch, adjustable tractor feed, original and 2 copies, 30 characters per second, and full graphics with a resolution of better than 60 dots per inch in both horizontal and vertical axes.

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stored on the disk. Files may be either Basic programs or data. A program loaded by its file name will be automatically executed.

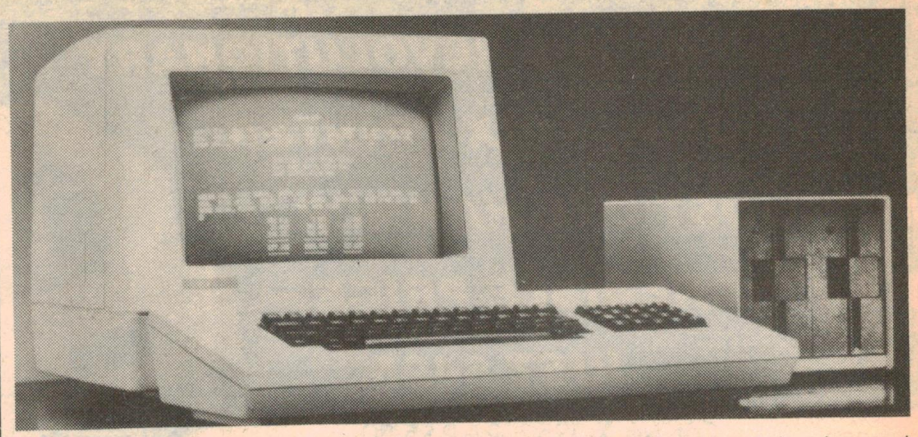
The second Basic program provided is a collection of disk utilities. Loading this program results in the display of a menu of options, including disk formatting, disk backup and copying, and various routines for checking the amount of free space remaining on the disk. Disks may be checked for readability by use of the Verify option, erased or dumped to the screen for checking.

Perhaps the most important point to remember is that these programs are written in Basic, and, while useful in themselves are only examples of how OS/80 can be used. The DOS itself is a skeleton which can be "fleshed out" to suit the user's own requirements. If you need more than 50 files in a directory, for example, simply change the relevant parameters in the file management program. If you want to experiment with other methods of organising disk storage, such as a virtual memory system, this too can be done. So the DOS is very flexible, and can be made as simple or as complicated as desired.

To assist the programmer in using OS/80, 12 error messages are provided, ranging from "Disk missing or door open" to "Can't format disk" and "Invalid sector number". All this and more is fully explained in the 30-page manual and primer which accompanies the OS/80 diskette.

Overall, our impressions of OS/80 are very favourable. For business and professional users it provides disk management functions ready to be added into their Basic programs. For the hobbyist and experimenter it can readily form the basis of a sophisticated Disk Operating System tailored to their own requirements. If you are contemplating adding a disk drive to your System-80, the OS/80 operating system is worth a close look.

Xerox enters the micro marketplace



Rank Xerox has entered the local computer market with the release of their 820 Information Processor. Apart from the fact that Xerox make it, however, there is very little which is new about the 820.

Based on the Z80A microprocessor, with 64K of RAM and 4K of ROM, the 820 runs CP/M, and is intended for use either as a word processor or as a small computer system for business management. Basic (both compiled and interpreted versions) and Cobol are available for the system, together with a Z80 assembler for software developers.

Other software includes Supercalc (TM), a records management and analysis package called "Analyst" and programs for sorting and merging mailing lists and other information.

The 820 will cost around $4000 with dual 14cm disk drives. As a word processor, with a 40cps daisy wheel printer and Xerox software the system will be about $7500.

One distinctive feature of the 820 is worth mentioning. Like many new Xerox products, the 820 can be connected to the Xerox "Ethernet" (TM), a system that links free-standing computers and other equipment into a single network, in keeping with the long-heralded "electronic office" concept.

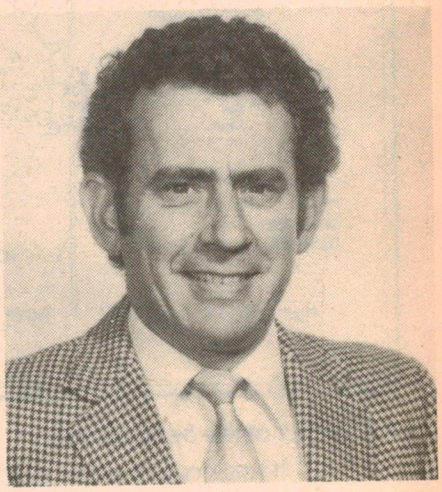
For more information contact L. J. Wilson, Rank Xerox (Australia) Pty Ltd, 111 Pacific Highway, North Sydney, NSW, 2060.

The Vic Centre

To coincide with the release of Commodore's low priced home computer, the VIC-20, Computerware of Melbourne has announced the establishment of "The Vic Centre".

The VIC-20 provides 16 colours, graphics, sound effects and Commodore Basic, all for around $399. It can connect to any television set. The Vic Centre aims to provide a one-stop source for the VIC-20, accessories and software. You can contact the Centre at 305 La Trobe Stree, Melbourne, 3000.

New manager at The Logic Shop



Mr David L. Browne has been appointed Sydney Branch Manager for The Logic Shop.

Advice on individual and business data processing is available together with a range of products from Apple, DEC, Texas Instruments, Northstar, QUME, OKI, Centronics, Sendata and Televideo. The Logic Shop (Sydney) is at 91 Regent St, Chippendale, NSW, 2008.

Microcomputer News & Products

Commodore dealers association formed

Commodore computer dealers from all states have banded together to enhance the position of Commodore products in Australia. Under the name "Australiasian Microcomputer Distributors" the group plans to streamline their marketing operations, sharing the cost of software development and advertising and taking advantage of bulk ordering.

John Guidice of The Microcomputer House Pty Ltd is the force behind the association. Other members are Compute CBM Systems of Caringbah, NSW, Pittwater Computer Sales, Ingelburn Business Machines in WA, C&W Electronics of Queensland, Computerworld in Darwin and Canberra, and BS Microcomp of Victoria.

The Microcomputer House is at 133 Regent St Chippendale, NSW, 2008.

Retailers group wants to set standards

Another new industry group, the Nationwide Computer Retailers and Resellers of Australia, has been formed in Melbourne. The main aims of the group are to act as a forum for computer retailers and a lobbying group with Government, to act as arbitrators in disputes, and as a clearing house for overseas suppliers and local distributors looking for sales outlets.

The association also hopes to act as a standards body for computer retailers, enabling those members which meet their standards to present themselves as "certified" dealers.

Chairman of the group is Gary Wayne Alpert, Managing Director of Computer Country in Melbourne. Inquiries are invited from retailers and resellers interested in joining the group. Contact the group C/o Computer Country, 338 Queen Street, Melbourne, Vic. 3000.

Computer/Shortwave experiment

On September 10th last year, Radio Netherlands made a unique experiment in international shortwave broadcasting. The station broadcasts a weekly "Media Network" program, dealing with aspects of communications. Since listeners in North America, Australia and New Zealand have indicated an interest in home computers, it was decided to experiment with transmissions of computer programs in cassette recorder format.

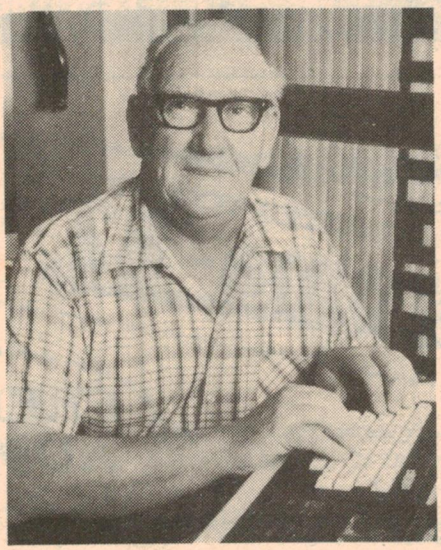
As shortwave broadcasting suffers from background noise, due to atmospheric and man-made interference, a test transmission was made. Listeners were asked to record the transmission of September 10 and attempt to load the program into their computer. This would check whether the signal to noise ratio was good enough to enable broadcasting of computer programs on an international scale. Apple, TRS-80 and Commodore PET system tape formats were selected for the experiment.

A total of 42% of listeners were successful in copying a program which was read by their computer.

10% of listeners who recorded the program off the air and were unsuccessful in loading it found that by re-recording the program tape and raising the level of the signal, their computer could read it. Five listeners reported that adjustment of the tone control, boosting the treble response, was critical. Bandwidth setting on the shortwave receiver was important. Those who used settings lower than 5kHz reported failure. Many other listeners were successful using only modest or average quality equipment.

Radio Netherlands intends to continue the experiment, with the next broadcast of computer programs scheduled for January 28th. Programs for the Sinclair ZX-81,TRS-80 Model I Level II and Commodore PET machines will be broadcast at 0750 UTC on 9715kHz and 9770kHz and again at 0850UTC on 9715kHz. Readers who try to record the programs should report their results to "Computer Experiment", Media Network, Radio Netherlands, PO Box 222, 1200 JG Hilversum, Holland. (For more details on Radio Netherlands, see "Shortwave Scene" in this issue.)

Computer prize to overcome disability



A retired Newcastle (NSW) man has won a System-80 computer in an Australia-wide competition entered by almost 100,000 people.

Mr G. Charlesworth won the computer in a competition which asked the entrant to give reasons why he wanted a computer. Mr Charlesworth's reasons were different from those of most other entrants. For many years he has suffered from deafness brought on by his prior employment and he finds it very difficult to communicate with others.

With the computer he can play games, either by himself or with others, compose letters and other messages and brush up on his maths. With inexpensive accessories he could also use the System-80 to communicate over the phone with other users, no longer handicapped by his deafness. Understandably, he is delighted with his prize.

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4MHz Z-80 CPU, 80 x 25 display with graphics and 8 colours, 32K RAM, 24K ROM, parallel/serial/cassette interfaces, upper/lower case, numeric keypad, 10 special function keys, access to CPM.

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Electronics is going digital. This book can help YOU go right along with it:

Electronic equipment now plays an important role in almost every field of human endeavour. And every day more and more electronic equipment is "going digital". Even professional engineers and technicians find it hard to keep pace. In order to understand new developments, you need a good grounding in basic digital concepts, and An Introduction to Digital Electronics can give you that grounding. Tens of thousands of people — engineers, technicians, students and hobbyists — have used the previous editions of this book to find out what the digital revolution is all about. The fourth edition has been updated and expanded to make it of even greater value.

Here are the chapter headings:

1. Signals, circuits and logic
2. Basic logic elements
3. Logic circuit "families"
4. Logic convention and laws
5. Logic design: theory
6. Logic design: practice
7. Numbers, data & codes
8. The flipflop family
9. Flipflops in registers
10. Flipflops in counters
11. Encoding and decoding
12. Basic readout devices
13. Multiplexing
14. Binary arithmetic
15. Arithmetic circuits
16. Timing & Control
17. Memory: RAMs
18. ROMs & PROMs
19. CCD's & magnetic bubbles
20. D-to-A converters
21. A-to-D converters

Glossary of terms

Available from "Electronics Australia", 57 Regent St, Sydney. **PRICE $4.50** OR by mail order from "Electronics Australia", PO Box 163, Chippendale 2008. **PRICE $5.20.**

Microcomputer News & Products

Apple III now available in Australia

Following some production difficulties, the Apple III is to be finally released in Australia this month. Electronic Concepts Pty Ltd will release the new machine through its Australian dealer network.

Modifications to the original design make the Apple III a more attractive system for business and professional use. The system now features an improved operating system, more reliable hardware, expanded disk storage and can support up to 256K bytes of internal memory. In addition, seven new applications programs have been released.

Expanded storage capacity is provided by the Apple III/Profile system. Profile is a five megabyte Winchester-type hard disk which provides almost 35 times more storage space than a single floppy disk.

Usefulness of the system is increased by the release of seven new or enhanced software packages. One such program, Access III, allows the Apple III to communicate with large mainframe computers. The Apple can thus be used as a remote work station, accessing large data bases and returning completed work to the central computer.

Other new software available includes Apple Writer III for wordprocessing, Visicalc (TM) III and Business Graphics III for preparing and analysing business information, and Business Basic and Pascal III for developing applications programs. Each Apple III also comes with a set of diskettes which contain the new SOS 1.1 operating system, utilities file and Apple II emulation software. The operating system supports up to 256K bytes of memory, guards against writing data on an incorrect disk, and provides a mode which allows Apple II software to run on the Apple III, providing access to a large library of applications programs.

There have also been some price changes, in the US at least. The Apple III with 128K bytes of RAM and operating system software is priced at $US3495. With Basic, Visicalc (TM), SOS and Monitor software, the system is $US4190 – $500 below last year's price.

Electronic Concepts, distributors of the Apple III, are at 55-57 Wentworth Av. Sydney, NSW, 2000.

Super-80 users group formed in Brisbane

● Users groups, in which members share programs, advice and experience are one of the strong points of the microcomputer scene, giving valuable assistance to newcomers and old-timers alike. Indeed, the popularity of a computer can often be judged by the strength of its user groups.

With almost 1000 Super-80's in use, it is high time that a user's group was established, and we are pleased to report that one group at least is under formation. The inaugural meeting of the Brisbane Super-80 users group will be held on 10th February 1982 at 7pm in room 21, first floor of the Trades Hall, Wickham Terrace, Brisbane. All are welcome to attend. For more information contact Garry Gatfield, 165 Frasers Rd, Mitchelton, Qld 4053.

● The Blue Mountains Computer Club (NSW) meets at the Springwood Civic Centre on the first Friday of each month. Further information is available from Eric Lindsay, 6 Hill Crest Ave, Faulconbridge, NSW, 2776, ph. (047) 51 1044.

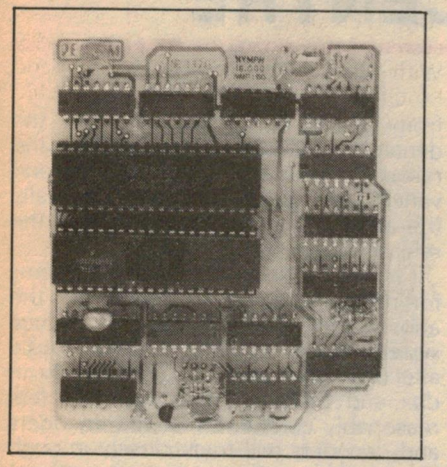
● Readers interested in joining an Atari users club in Brisbane should contact Will Visser, 74 Shailler Rd, Shailler Park, Qld. 4128, ph. (07) 209 1574.

● The ZX80 Users Club publishes a well presented newsletter, with hardware and software hints, programs and comments on the Sinclair computers. The address to write to is 24 Peel St, Collingwood, Vic 3066.

SYSTEM 80 AND TRS-80 COMPUTING

The Percom Peripheral

Percom's DOUBLER II™ tolerates wide variations in media, drives



The Revolutionary PERCOM DOUBLER™

GARLAND, TEXAS —
Harold Mauch, president of Percom Data Company, announced here today that an improved version of the Company's innovative DOUBLER™ adapter, a double density plug-in module for SYSTEM 80 and TRS-80 computers, is now available.

Reflecting design refinements based on both theoretical analyses and field testing, the DOUBLER II plugs into the drive controller IC socket of a SYSTEM 80 or TRS-80 Expansion Interface and permits a user to run either single or double density diskettes.

With a DOUBLER II installed, over four times more formatted data — as much as 364K bytes — can be stored on one side of a five inch diskette that can be stored using a standard drive system.

The critical clock-data separation circuitry of the DOUBLER II is a proprietary design called a ROM-programmed digital phase-lock data separator.

According to Mauch, this design is more tolerant of differences from diskette to diskette and drive to drive, and also provides immunity to performance degradation caused by circuit component aging.

Mauch said "A DOUBLER II will operate just as reliably two years after installed as it will two days after installation."

The digital phase-lock loop also eliminates the need for trimmer adjustments typical of analog phase-lock loop circuits.

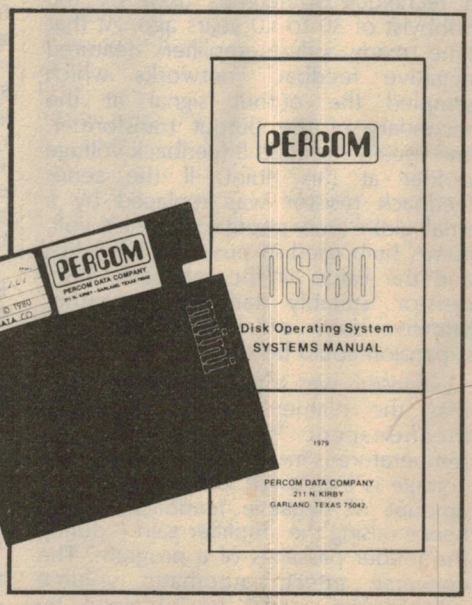
"You plug in a Percom DOUBLER II and then forget it," he said.

The DOUBLER II also features a refined Write Precompensation circuit that more effectively minimises the phenomena of bit and peak-shifting, a reliability-impairing characteristic of magnetic data recording.

The DOUBLER II, which is fully software compatible with the previous DOUBLER, is supplied with DBLDOS™, a TRSDOS compatible disk operating system.

The DOUBLER II (Cat. X-3540) sells for **$229.00,** including the DBLDOS™ diskette and a comprehensive user manual, at all Dick Smith stores.

Note: The System 80 Expansion Unit's external data separator must be disabled when using the Doubler. Technical details are available — ask to see Technical Bulletin No. 44.



OS-80 Disk Operating System now available in Double Density

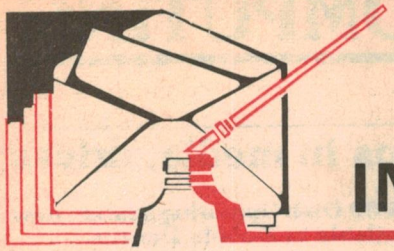
GARLAND, TEXAS — Percom's OS-80 Disk Operating System, formerly called MicroDos, is now available in a double density form as well as the original single density version. This means that the users of Percom's new Doubler II can now retain all of the features of OS-80, combining these with the higher speed and efficiency of double density operation.

Those who have already been using OS-80 for single density operation will know that its prime features are speed, the small amount of memory required for the DOS itself (less than 7K bytes), and extreme simplicity of operation. The last of these is due to the fact that OS-80 uses Level II BASIC commands for both DOS and Disk BASIC functions, giving the programmer complete and explicit control over all disk operations — whether they involve programs or data. This makes OS-80 very suitable for use by the newcomer to programming, as all disk operations can be achieved using simple BASIC programming.

These advantages have made the original single-density version of OS-80 particularly good value for money at only **$35.00,** and a great many people have purchased them in Australia through the many branches of Dick Smith Electronics (who sell it as Cat. X- 3555).

The new double-density version is known as OS-80D, and sells in Dick Smith Electronics stores at Cat. X-3545 for **$72.50.** It offers all of the features of the original product, converted for double-density operation. As a result, users of the Doubler II recording adapter now have a choice of two different disk operating systems for their double-density operation: the DBLDOS supplied with the Doubler II itself, or OS-80D.

STOP PRESS . . . The Percom "Patch-Pak" is still available, for those who want to convert their TRS-DOS operating system for use with 40-track disk drives. It's available from all Dick Smith stores as Cat. X-3550, and costs only $20.00.



INFORMATION CENTRE

SUPER BASS FILTER: I recently built the Super Bass Filter detailed in your February 1980 issue. (File No. 1/F/13). I spent a considerable amount of money on an amplifier and bass speaker and since then I have found that by having the bass filter connected to the loudspeaker output of the main amplifier I am getting a distortion in the main loudspeakers. When the bass filter is disconnected from the main amplifier the distortion disappears. Could you please let me know how to solve this problem? (J. S. Bondi, NSW.)

● The most probable cause of the distortion is due to a groundloop involving the earth connections of the two amplifiers which are both connected together via the mains earth and via the earth at the input and output of the super bass filter. This could cause high frequency oscillation which usually manifests itself as distortion, as you have observed.

One possible solution would be simply to disconnect the earth connection from the input of the super bass filter to the earth of the speaker output or to insert a 10Ω resistor in series with this connection.

LIGHT BEAM RELAY: I have made the Light Beam Relay described in your November 1980 issue.

The problem is a lack of sensitivity. The LDR has to be nearly in total darkness, using the light source described at a distance varying from 50cm down to approximately 5cm.

I hope you can "shed some light" on this problem for me. (C. B., Girraween, WA.)

● The three most likely reasons for your problem are: (1) excess ambient light, (2) lower than stated value of 100kΩ resistor feeding the LDR, and (3) higher than stated value of 1kΩ resistor feeding the sensitivity trimpot. We are assuming that you have aligned the hole in your box to reasonably accurately align with the active area of the LDR. If not, you may be needlessly setting the preset sensitivity control abnormally high, thus creating problems with ambient light.

Assuming a correctly functioning unit, maximum sensitivity can be achieved by lining up the light source and LDR in darkness. Advance the sensitivity control so that the relay is just pulled in when the light source is extinguished. Now by orientating the light source to the LDR, sensitivity should be such that the relay drops out when the units are spanning a normal doorway. In the case of the prototype, this distance was of the order of two metres.

Having arrived at this setting, extinguish the light source and restore the ambient light. The relay should remain activated. But if the relay drops out, spill of ambient light is reaching the LDR. In this event, determine the source of entry to the LDR and shield appropriately.

COMPRESSOR-EXPANDER: I have been told that a light bulb correctly wired into a stereo system can reduce noise much the same as a compressor-expander does. I was wondering whether "Electronics Australia" has heard of this.

If so could you please give a quick rundown on how and where to wire it. (I think it is between the amplifier and the speakers). Also how many watts and what voltage bulb should be used. (T. L. Bundanoon, NSW.)

● Automatic volume expansion by means of a small incandescent bulb was a technique sometimes used by the hobbyist of 30 to 40 years ago. At that time many valve amplifiers featured negative feedback networks which sampled the output signal at the secondary of the output transformer, and usually included a feedback voltage divider at this point. If the series feedback resistor was replaced by a small globe (very popular was the 6 volt, 60mA bulb used in pushbike tail-lights) and the value of the feedback shunt resistor suitably tailored, a rather primitive form of automatic volume expansion could be obtained.

Expansion was obtained from the fact that the filament resistance of an incandescent lamp rises as its temperature is increased (ie, the applied voltage is increased), thus reducing the amount of negative feedback – and hence raising the amplifier gain – during the louder passages of a program. The converse effect, automatic volume compression, could be obtained by interchanging the positions of the bulb and shunt resistor.

This technique was unsatisfactory because (1) feedback was being reduced at the times when it was most needed (during the louder passages); (2) the expansion characteristic varied according to the level at which the music was played; (3) the expansion characteristic varied from one bulb to another (due to the wide tolerances from globe to globe); and (4) the dynamic characteristics (attack and release times) were unsatisfactory and varied from globe to globe. Generally the attack time was excessive, and the release time insufficient.

It is best to avoid such simple systems for noise reduction, as apart from the above, they invariably cannot reduce system noise without simultaneously affecting other sonic qualities. Only in dbx and Dolby systems can one feel reasonably confident that the encoders and decoders will track closely enough to provide noise reduction without degradation of sonic content.

INFRARED RELAY: I have just completed an infrared light beam relay (April 1981) and was disappointed to find that its range was only 0.5 metres and not five metres as mentioned in the article. The only deviation from the circuit components used was two LD271 IR LEDs and a BPW34 IR diode. Could you tell me if these have a poor frequency match or could there be some other reason. (B. B., Lennox Head, NSW.)

● The BPW34 photodiode is electrically equivalent to the BPW50 device specified in the article except that it does not include an infrared filter. If you have not installed a filter, then ambient light will severely degrade the performance of the unit. The solution is either to use an infrared filter positioned in front of the BPW34 or use a BPW50 instead.

We have also published a Notes & Errata on the IR relay to the effect that the 2.7kΩ resistor connected to the collector of Q3 should be 3.3kΩ. If a 9V plug pack is being used to power the receiver, connect a 39Ω resistor in series with the supply and a 9.1V zener from the circuit side of the resistor to ground. If a buzzer or other load is connected to the collector of Q5, connect the supply side of the load before the zener regulator.

TV-CRO ADAPTER: I always read "Information Centre" in EA and noticed in the November issue that C.M. of Wollongong was having trouble with his TV-CRO adapter in the horizontal mode on 9V supply.

Having faced a similar problem I would like to point out that changing from the designed 12V to 9V supply does change critical voltages on the base of the BC549 and pin 5 of IC1a, and a change in some resistance values becomes necessary.

A change from 15kΩ to 22kΩ in the base bias network enabled me to centre the display by trimpot and a change from 10kΩ to 15kΩ between pin 5 and earth matched the no signal input voltages on pins 4 and 5. In order to have sync over a wide range of signal levels, it was also found necessary to remove the positive feedback loop on IC1a or at least increase the resistance in the leg substantially (from 47kΩ to 470kΩ), otherwise when output 2 went "high" further crossing was prevented – pin 5 rising beyond peak signal voltage on pin 4. Burr-Brown's book "Operational Amplifiers" pp.363-364 discusses the complication of positive feedback.

After the above changes, with sync "on" a reasonably good coherent display was attained in the horizontal mode and a steady strobe in the vertical mode. It would be appreciated if, one way or another, C.M. could read this letter as a possible help with his problem. (W. L., Harbord, NSW.)

● Thank you, W.L., for your helpful hints. As you can see, we have passed them on for all to see.

TRANSISTOR-ASSISTED IGNITION: I would like to fit your Transistor-Assisted Ignition with dwell extension, (December 1979) to a car with positive earth.

If it is possible to use your system would you please tell me what modifications are required to convert it. (S. L., Thomastown, Vic.)

● Sorry, but it is not possible to use our Transistor-Assisted Ignition system on vehicles which have the battery positive earthed. Nor would we recommend modifying the TAI with alternate polarity active devices, as this could well lead to reliability problems.

Actually we were under the impression that virtually all vehicles marketed over the past nine or 10 years conformed with the negative ground system. We remember that a percentage of vehicles which were equipped with generators (dynamos) featured the positive ground system. Should your car have a generator (not an alternator) it may be a worthwhile proposition to reverse polarise its system.

However, this is only practicable if its electronic accessories (radio, tachometer, etc) can also be reversed polarised. The method is quite simple.

Firstly disconnect all electronic accessories. Now reverse the battery cables (usually best to also reverse the battery in its carrier at the same time). Remove the cover from the cut-out/voltage regulator unit and establish which "relay" is the cut-out. Lightly press its armature to its pole piece for approximately one second. The generator will now be reversed polarised, and all the vehicles' own electrical equipment should function as before. Try lights, horn etc, then start the engine and confirm that the generator is charging the battery.

Finally, reverse polarise the previously-disconnected electronic accessories, and reconnect them back into the system. The job is now complete, and you may add any further negative earthed accessories, such as the Transistor-Assisted Ignition system, that you desire.

Digital Speedometer

DIGITAL SPEEDOMETER: I am currently rebuilding a Leyland Mini and am altering the dashboard. In my alterations I would like to include a digital speedometer, along with a few other gadgets – transistor-assisted ignition and maybe the opto-electronic ignition system.

As yet, I have not been able to locate any information on a digital speedometer other than a write-up on "Electronics In Your Next Car" in "Radio Electronics", December, 1980. I would greatly appreciate it if you could tell me where I can get a circuit for a digital speedometer. (G. G., Morphett Vale, SA.)

● We have not published a circuit for a digital speedometer. However, if you feel you have the technical expertise, you may be able to design a custom unit for your own application. Two units are required. Firstly a transducer to convert the rotary motion of the speedo cable into electrical impulses. For this you may acquire a second-hand speedo "head", from which all the internal mechanism, except for the drive spindle, should be removed and discarded.

A light chopping disc, similar to that used in our Wind Speed Indicator published in the October, 1981 issue could be mounted on the drive spindle inside the speedo housing. In similar fashion to the Wind Speed Indicator, mount a LED and phototransistor, one each side of the chopper disc. This could then be adapted to interface with a simple frequency meter with three digit display. This could be based on one of our frequency counters such as the "Upgraded Digital Frequency Meter" of August, 1978.

In this case, the mains power transformer and rectifier diodes would be omitted, as would be the "most significant" digits, and their associated drive circuitry, (ie, one 74C926 can be omitted). This is because it is only necessary to display the last three digits for motor vehicle applications. As the modified counter need only count to some 200Hz (corresponding to 200km/hr), the range switch would also be deleted.

Calibration of the digital speedo is determined by both the clock frequency, and the number of pulses per revolution of the chopper disc.

The clock would have to be free-running instead of crystal-controlled and set to enable calibration with the sensor used.

DIGITAL ANALOG STORAGE CRO ADAPTER: I have recently constructed the Storage CRO Adapter described in November 1980 and January and March 1981 and have found the waveform storage erratic. The Set LED operates normally and can be extinguished by proper juggling of the attenuation, gain and trigger controls. On an oscilloscope, waveforms about both CA3140 ICs and 555 appear to be correct. Further, the chip select and write enable waveforms are also present and appear to be correct. Both timebase controls are also working normally.

When triggered, it appears that only the negative half of the waveform is stored, but on high memory speeds a reasonable sinewave can be produced. Further, the digital storage mode appears inoperative. Both clocks are working correctly. Unfortunately the workings of the A/D are impossible to follow due to the high clock rate.

I might also point out that the 2112 memory chips are unavailable. From talking to people in the industry, it would appear that this situation will not change. The 2114 memory which is available can easily be wired into the circuit, although it has different pinouts. I have tried both the 2112 and 2114 memories, both with the same results. (A. E. Clayton, Vic.)

● Possibly the best approach to take in trouble shooting your Storage CRO Adapter is to track down the fault with the digital storage first. Since you cannot retrieve the stored digital signal, the retrieval of memory data is probably also not effective in the analog storage mode, which would explain the clipped waveforms you receive. The fault is likely to be associated with IC8, the 2112 memory and the $\overline{CE}$ and $\overline{WE}$ controls. Make sure that when storing the data that $\overline{CE}$ goes low on the positive cycle of the clock input to IC7 and that the $\overline{WE}$ is low. Upon reading of the data, $\overline{CE}$ should be low and $\overline{WE}$ high. Also check that the address lines increment correctly.

Regarding the availability of the 2112 memories, kit suppliers have had difficulty keeping up the supply. However, the readily available 2114 can be wired into the circuit as you suggest.

NOTES & ERRATA

SLIDE CROSS-FADER (November 1981, 2/PC/32): The 10kΩ resistor shown across pins 8 and 10 of the PC board overlay diagram should be a 100kΩ , as shown on the circuit diagram. Also on the same wiring diagram, the unlabelled lead from switch S3 should connect to pin 18 on the PC board.

MARKETPLACE

DISPLAY ADVERTS IN MARKETPLACE are available in sizes from a minimum of 2cm x 1 col rated at $15 for a col cm.
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AMIDON FERROMAGNETIC CORES — Large range for all receiver and transmitter applications. For Data and price list send 105 x 220 SASE to: R.J. & U.S. Imports, Box 157, Mortdale, NSW 2223.

CB RADIOS 23AM $59, 18AM $79, 40 with scan $129, 18SSB $179, 40SSB $195, FRG7 $275, VHF Aeradio $27, RTTY $120, FM 320 $259. Servicable CB AM $39, SSB $69. Post anywhere $5. Park Disposals, 32 Park st, Sydney 2000. Ph (02) 264 7515.

16K S-100 4MHz Static RAM. California Computer Systems model 2016 with Bank Select Manual, etc. New and experienced guaranteed OK. Retail $330 sell $165. Phone (069) 53 2848.

EPROM PROGRAMMER Advanced features. Connects to ANY uP System. EPROM PROGRAMMING service also available. More info send 30c stamp NUTEK SALES, PO Box 95, Eastwood NSW 2122. Ph 02 871 7042.

SINCLAIR ZX81 — including power supply and instruction manual. Ph (Melb) 583 1084

FOR HIRE

MICRO RENTAL Microcomputer systems of various models and configurations with peripherals, are available for hire from DORF MICROCOMPUTER. Start-up and reference manuals included. Sydney 922 1644 or 960 1808 (AH).

CLUBS

HEAR THE WORLD! Australian Radio DX Club offers a monthly bulletin on reception of shortwave, mediumwave, utility and amateur radio. Monitoring, reception reporting and receiving verifications (QSLs) from radio stations worldwide made DXing the hobby for all ages. A wide range of publications and services are available to members. Send a 24c stamp for details to: ARDXC, Box 260, Carnegie Vic 3163, mention EA!

Serviceman

Continued from p78

Suddenly, everything made sense, including the apparent inconsistency whereby a TNP65113 board appeared to have a fault when used in one set, but not in another. What in fact had happened was that, in swapping the boards, I had simply found a better mating combination between boards and connectors.

As far as the set on hand was concerned, the obvious first step was to clean the contacts thoroughly and hope that this would be sufficient. In fact, it made a very considerable improvement, to the point where I was able to reset the sub-brightness control back to a point very close to where it had been when I first received the set.

So that solved that problem, at least on a short term basis. I have no idea how long the treatment will last, and I explained the situation to the customer when I returned the set to him. If it doesn't last we will have to consider fitting a new contact strip.

At this point I decided to make a routine call on the first set, partly to check its behaviour and partly to give its contact assemblies a good cleaning. Unfortunately, all was not well, the picture again tending to excessive brightness. But it was for a different reason; my suspicion of a gassy tube was correct. It had deteriorated a lot faster than I had expected, and was now drawing excessive current and pulling the driver collector voltages down.

So as I write, the set is back in the workshop awaiting a new tube. Before agreeing to fit it I made sure the owner understood the situation in regard to the edge connectors and the possibility that they may eventually have to be replaced, at some cost. He is prepared to take this risk.

So there it is — two exercises which may not have been all that profitable, but from which I learned a good deal about two popular sets. I will be on the look-out for these two faults from now on.

CLASSIFIED ADVERTISERS

To the Advertising Manager, ELECTRONICS Australia, Box 162, Beaconsfield, 2014.
- Please insert the following advertisement in the first available issue.
- Tick the classification required ☐ FOR SALE ☐ WANTED ☐ FOR HIRE ☐ CLUBS ☐ POSITION VACANT ☐ POSITION WANTED ☐ READER SERVICE

Please print in ball-point pen using capital letters only where necessary.

Signed .....

Address .....

I enclose Cheque/Money Order for $ .....

being full payment for ..... letters at $3.60

for 40 letters or part thereof (minimum 80 letters).

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CAPACITORS

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2000 MFD. VDcw25	75c ea.
0.0039uF, 1500V	20c ea.
6N8, 1500V	20c ea.
0.0068uF, 1500V	20c ea.
1200PF, 400V	10 for $1
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2200PF, 630V	10 for $1
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0.10uF, 400V	5 for $1
0.082uF, 160V	10 for $1
26k, 250V	10 for $1
0.041uF, 400V	10 for $1
0.033uF, 250V	5 for $1
0.027uF, 100V	20 for $1
220uF, 10V	10 for $1
1uF, 350V	10 for $1
470uF, 40V	5 for $1
1000uF, 16V	25c
2.2uF, 200V	10 for $1
0.047uF, 1500V	50c
47uF, 25V	4 for $1
680uF, 40V	50c
22K, 100V	20c
330uF, 25V	25c
2.2uF, 200V	30c
470uF, 40V	50c
680uF, 35V	50c
0.015uF, 250V	25c
1uF, 100V	25c
1000uF, 16V	50c
220uF, 16V	50c
2000uF, 63V	$1
0.47uF, 400V	50c
680K, 250V	25c
012, 250V	25c
15NF, 250V	10c
120K, 250V	20c
10uF, 315V	25c
0.056, 250V	10c
500 MFP 10 VOLT	5 for $1
68uF 63V	5 for $1

SPECIAL TRANSISTORS

AD 161-162	$2.50 pr
BSC 901A	$1.50 ea.
BC 548	10 for $1
AD 149	$3 pr
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BD202N	50c
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2NC055	$1

ELECTROS

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400uF, 10V	5 for $1
47uF, 63V	5 for $1
350uF, 16V	2 for $1
27uF, 160V	5 for $1
25uF, 63V	10 for $1
22uF, 160V	10 for $1
47uF, 16V	5 for $1
47uF, 200V	5 for $1
220uF, 10V	10 for $1
68uF, 16V	10 for $1
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Circuit Diagrams supplied

CRYSTALS FOR COLOUR TV 03061 NDK $2.50

COLOUR INFRA RED AUDIO TRANSMITTER $5

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Dual 500K	3 for $1
1 Meg	3 for $1
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100 mixed resistors, all useful	$2
100 mixed capacitors, fresh stock	$2

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3.5m to 3.5m, 7ft	75c
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6.5m, 7ft	50c

MICRO SWITCH
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2 and 3 gang	$1 ea.
Min 2 gang	50c

SUPER SPECIAL

GRAMOPHONE motor and pickup 3 speed stereo balanced arm. 240 volt $9.75

PP NSW $1.50
Interstate $2.75
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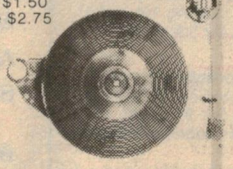
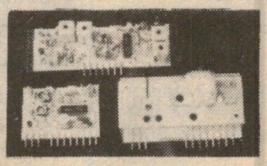


SUPER SPECIALS
FM STEREO TUNER KITS



Sets of 3 modules include FM tuner, decoder and IF detector. Circuit diagram supplied. Can be used with amp modules.

ONLY $22
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Colour deflection boards to suit Kriesler, Philips, Pye etc. (Circuit diagrams supplied.)

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11 INCH TURNTABLE, CUING DEVICE, SHEILDED MOTOR, MAGNETIC CARTRIDGE, ANTI SKATE. BASE $50 PERSPEX TOP $22 EXTRA

PP NSW $2
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Magnavox 10 Inch Woofer, 10 Inch Mid-Range 20W 80HM System I$20 A PAIR

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P&P NSW..$1.60 INTERSTATE..$2.80

COLOUR FRONT END COMPLETE PUSH BUTTON TUNER SECTION
TO SUIT PHILIPS, PYE, KRIESLER ETC. **$25**

Picture Tube Boards

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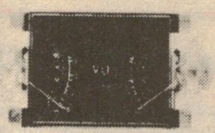

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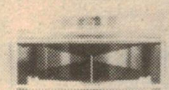

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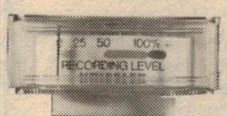

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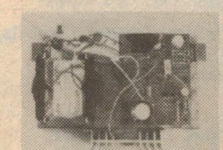

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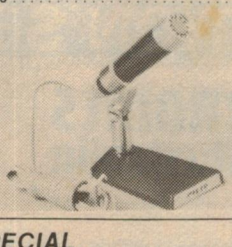

SPECIAL

SPEAKER CROSSOVER NETWORKS 2WAY FREQ 4KHZ 30W 80HM

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½ Meg	30c
1 Meg	30c
100K	30c
100K Switch	50c
50K Double Pole Switch	50c
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10K Switch	50c
250K	30c
50K	30c
20K	30c
10K Min Pots	25c
50/ohm	50c
½ or 1 Meg Switch	50c
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20K wire wound	75c
dual log 10K	75c
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250K ganged pots	75c
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2 Min Transistor 450 IF KC Coils Plus 1 Min Oscillator Coil	3 for $1

TV EHT Leads
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Pick up Cartridges BSR universal type Ceramic Stereo	$5
Diamond stylus stereo magnetic	$12

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DSY 130YO	50c
OA 636	50c
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BY 188	30c

DIODES BAV20 10 for $1

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6 x 4 27 ohm	$4.50 ea.
6 x 3 27 ohm	$3.50 ea.
5 x 3 27 ohm	$3.50 ea.
5 x 3 47 ohm	$3.50 ea.

Power leads and sockets 240 volt, suit most tape recorders, radios, etc, $1 each.

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HOR Drive 3021 transformers for colour TV	$2
TV Colour Convergence Units 11270 44 x 6	$3

PILOT LIGHTS

Screw in 6.3V	10 for $1.50
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PHOTOSTAT COPIES: $3 per project, or $6 where a project spreads over multiple issues (price includes postage). Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries. We reserve the right to supply complete back issues instead of photostats, where these are available.

CHASSIS DIAGRAMS: For the few projects which require a custom metal chassis (as distinct from standard cases) dyeline plans showing dimensions are normally available. $3 including postage.

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COMPONENTS: We do not sell electronic components. Prices and specifications should be sought from advertisers or agents.

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ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Chippendale, 2008.

EA PC BOARDS AND FRONT PANELS

Some readers have problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and their advertisements should be checked in the first instance. Failing that, below is a list of firms which produce or sell PC boards and front panels.

NSW

Dick Smith Electronics,
125 York Street,
Sydney, 2000.
Telephone 290 3377.
DSE also has branches and resellers throughout Australia.

Electronic Agencies,
115-117 Parramatta Road,
Concord, 2137.
Telephone 745 3077.

Jaycar Pty Ltd,
380 Sussex Street,
Sydney 2000.
Telephone 264 6688.

Radio Despatch Service,
869 George Street,
Sydney 2000.
Telephone 211 0816.

RCS Radio Pty Ltd,
651 Forest Road,
Bexley, NSW 2207.
Telephone: 587 3491

VIC.

Rod Irving Electronics,
425 High Street,
Northcote, 3070.
Telephone 489 8131.

Kalextronics,
101 Burgundy Street,
Heidelberg 3084.
Telephone 743 1011.

Sunbury Printed Circuits,
10 Counihan Street,
Sunbury 3429.

SA

James Phototronics,
522 Grange Road,
Fulham Gardens, 5024.

WA

Altronics Distributors,
105 Stirling Street,
Perth 6000.
Telephone 328 1599.

Jemal Products,
8/120 Briggs Street,
Welshpool, 6106.

N.Z.

Marday Services,
PO Box 19 189,
Avondale, Auckland.

Mini Tech Manufacturing Co Ltd,
PO Box 9194,
Newmarket.

Printed Circuits Limited,
PO Box 4248,
Christchurch.

ADVERTISING INDEX

WE CAN PUT ALL THIS IN THE PALM OF YOUR HAND.

What you are looking at is perhaps the most advanced VHS home video system you can buy.

The tape glides in and out of the machine, automatically.

The two-way shuttle search lets you view the picture at ten times the normal speed, so you can quickly find any segment you want to play again.

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If you go away, this home video system will record programmes for up to 14 days on up to eight channels.

In fact, this system has so many features, we don't have space enough to list them all.

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For instance, look at our cordless remote control unit. With every function of the machine itself, there is no other remote control that gives you so much control.

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For further information, write to JVC Advisory Service, 5-7 Garema Circuit, Kingsgrove N.S.W. 2208, or phone (02) 750 3777.

JVC002EA/FMMH

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